Saskowski, Ronald

From: Miller, Scott
Sent: Monday, October 05, 2015 2:00 PM
To: Saskowski, Ronald
Subject: FW: Smokey Mountain Smelters RI/FS
Attachments: SMSESI.PDF

Hello Ron,
Please save this to SEMS for Smokey Mountain Smelters.
Thank you,
Scott

From: Austin, Janice [mailto:Jaustin@versar.com]
Sent: Monday, October 05, 2015 1:48 PM
To: Miller, Scott
Cc: Ostrofsky, Arnold; Kestle, Rusty
Subject: RE: Smokey Mountain Smelters RI/FS

Hi Scott,

The referenced information was from the 1999 SI (Volume 1 – 33MB and Volume 2- 41MB) and 2005 ESI (attached). I also have a lot of the historical information Burl Maupin provided to me back in 2011. Rusty suggested placing all the historical information on a CD and sending to you that way the Data Management group at EPA can cross check what information EPA may need.

Please let me know if amenable and I will work with Mike Profit to have a CD prepared.

Janice

From: Miller, Scott [mailto:Miller.Scott@epa.gov]
Sent: Monday, October 5, 2015 10:55 AM
To: Austin, Janice <Jaustin@versar.com>
Cc: Ostrofsky, Arnold <Aostrofsky@versar.com>; Kestle, Rusty <Kestle.Rusty@epa.gov>
Subject: RE: Smokey Mountain Smelters RI/FS

Thank you, Janice. That would be great! Put it on Rusty's tab. ☺

From: Austin, Janice [mailto:Jaustin@versar.com]
Sent: Monday, October 05, 2015 10:48 AM
To: Miller, Scott
Cc: Ostrofsky, Arnold
Subject: RE: Smokey Mountain Smelters RI/FS

Hi Scott,

This information appears to be a part of the site background information included in the documents. I will find the referenced report and provide for your information.

Thanks,

Janice

From: Miller, Scott [mailto:Miller.Scott@epa.gov]
Sent: Monday, October 5, 2015 10:03 AM
To: Austin, Janice <Jaustin@versar.com>
Subject: Smokey Mountain Smelters RI/FS

Good morning, Janice,
Can you tell me how you came up with this information from the RI/FS?

In addition, a 1983 Tennessee Department of Environment and Conservation (TDEC) geologic investigation report indicates that the landfill was used for the disposal of "salt cake," which resulted from processing aluminum ore. Based on historical records, the former landfill appears to have been in the same location as the exterior (salt cake) waste pile currently on the SMS property. The Aluminum Company of America (Alcoa) sent large quantities of wastes, potentially containing hazardous substances, to the SMS facility between 1985 and 1992. The wastes included dross, filters, furnace bottoms, oily scalper chips, tabular balls, salt cake, and pot pads. Cyanide compounds are typically found in spent pot liners.

Thank you,
Scott Miller
Remedial Project Manager
Superfund Restoration & Sustainability Section
U.S. EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303
(404) 562-9120
fax: (404) 562-8896

EPA Superfund
Expanded Site Inspection:

SMOKEY MOUNTAIN SMELTERS
EPA ID: TN0002318277
09/01/05
KNOX COUNTY, TN

EXPANDED SITE INSPECTION

Smokey Mountain Smelters
TN0002318277
Knox County, Tennessee

September 2005

Burl H. Maupin
Environmental Protection Specialist
TN Department of Environment and Conservation
Division of Remediation

TABLE OF CONTENTS
EXPANDED SITE INSPECTION REPORT
SMOKEY MOUNTAIN SMELTERS
KNOX COUNTY, TENNESSEE 37920
TN DIVISION OF REMEDIATION SITE # 47-559
U.S. EPA ID # TN0002318277
VOLUME 1

✠

(continued)

TABLE OF CONTENTS (continued)
EXPANDED SITE INSPECTION REPORT
SMOKEY MOUNTAIN SMELTERS- KNOX COUNTY, TENNESSEE 37920
TN DIVISION OF REMEDIATION SITE # 47-559 U.S. EPA ID # TN0002318277

TABLES

FIGURES

APPENDICES

APPENDIX 1 - PROPERTY DEEDS, OWNERSHIP CARDS
APPENDIX 2 - LABORATORY FORMS
Analytical Results Reports Requests Chain-of-Custody
APPENDIX 3 - SAMPLE LOCATION COORDINATES
FIELD NOTES AND DOCUMENTATION
APPENDIX 4 - CRITERIA OF CONCERN
APPENDIX 5 - LEACHATE INVESTIGATION

REFERENCES - VOLUME TWO

EXECUTIVE SUMMARY
EXTENDED SITE INVESTIGATION REPORT
SMOKEY MOUNTAIN SMELTERS
KNOX COUNTY, TENNESSEE 37920
TN DIVISION OF SUPERFUND SITE # 47559
U.S. EPA TN0002318277

This Extended Site Investigation Report presents the findings of a study conducted at the Smokey Mountain Smelters (SMS) Site, 1508 Maryville Pike, Knox County, Tennessee. The Site is located in Knox County, just outside the Knoxville City Limits. The former manufacturing operations are inactive, and the Site is abandoned and unused.

Concern for the potential release of hazardous substances at the site is due to the nature of the former manufacturing operations (secondary aluminum smelting; agricultural chemical manufacturing), and past environmental violations.

The probable point of entry to surface water is believed to be the surface drainage to the nearby unnamed tributary of Flenniken Branch. The Stream is classified for Fish and Aquatic Life, Recreation, Irrigation, and Livestock Watering and Wildlife. At approximately 1.6 miles along the surface water pathway is the Flenniken Branch embayment of the Tennessee River (Fort Loudoun Lake) where the remainder of the surface water pathway is additionally classified for Domestic Water Supply, Industrial Water Supply, and Navigation.

Additional investigatory efforts are required to determine the type, depth, and quantity of hazardous substances and to determine the threats posed by air emissions from the wastes, by potentially contaminated groundwater, by potentially contaminated water and sediment in the surface water pathway, and by potentially contaminated soil on and off the Site.

The site is recommended for further investigation through the CERCLA process.

EXPANDED SITE INSPECTION REPORT
SMOKEY MOUNTAIN SMELTERS
KNOX COUNTY, TENNESSEE 37920
U.S. EPA ID # TN0002318277
TN DIVISION OF REMEDIATION SITE # 47559

1. INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the United States Environmental Protection Agency (U.S. EPA) conducted an Expanded Site Inspection (ESI) at the Smokey Mountain Smelters Site in Knox County, Tennessee, 37920. The Tennessee Division of Remediation (DOR), formerly the Division of Superfund (TDSF), under contract with the U.S. EPA, prepared and issued this ESI Report. This Site was assigned the identification number of TN0002318277 by the U.S. EPA (Ref 44), and 47-559 by the State of Tennessee Department of Environment and Conservation. The purpose of this investigation was to collect information concerning conditions at the Site sufficient to assess the threat posed to human health and the environment and to determine the need for additional CERCLA SARA or other appropriate action.

The scope of this investigation included on-site reconnaissance visits, and the sampling of environmental media. The information gathered was utilized to support evaluation of this Site under the Hazard Ranking System (HRS). The site inspection included a review of hazardous substances potentially present at the Site, a review of previous site assessment data, gathering information and supporting documentation to characterize the human population and adjacent environment that could be impacted by any contamination present at this Site, and interpretation of analytical results.

2. SITE CHARACTERISTICS, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

2.1 Location

The Smokey Mountain Smelters (SMS) Site consists of three land parcels and a large, rectangular, metal building located just outside of the city limits of Knoxville, in Knox County, Tennessee, on Maryville Pike, State Secondary Route 33 (Vicinity Map, Figure 1). The geographic coordinates of this facility, at the toe of a waste pile near a leachate spring (Appendix 3), are 35 degrees, 55 minutes, and 03.1 seconds North Latitude, and 83 degrees, 55 minutes, and 39.8 seconds West Longitude, placing it in the fifth nth of the Knoxville Quadrangle (0147NW). The immediate area surrounding the facility is medium commercial and residential development. The property location, 1508 Maryville Pike, is that listed for the parcel upon which the process building lies (Appendix 1, Ownership Card, Parcel 1).

To access the Site from Knoxville, travel south on Henley St. U.S. 441 Chapman Hwy, approximately one mile past the bridge over the Tennessee River to a traffic light where Maryville Pike intersects on the right. Travel south on Maryville Pike State Secondary Route

FIGURE 1 - VICINITY MAP

33 approximately 1.8 mile to Caleb Ave. on the left, just before the Maryville Pike overpass of the CSX Railroad. The entrance to the Site is at the other end of the 500 feet length of Caleb Ave. To access the Site from Knoxville's McGee Tyson airport travel 3.2 miles north on Alcoa Hwy. / U.S. 129, right onto Gov. John Sevier Hwy. / State Secondary Route 168 for one mile to Maryville Pike/ State Secondary Route 33, then north for 2.7 miles to Caleb Ave. on the right just after the overpass of the CSX Railroad.

East Tennessee does not lie directly within any of the principle storm tracks that cross the country. The area is influenced primarily by storms that pass along the Gulf Coast and thence up the Atlantic Coast, and to a lesser extent by those that pass northeastward from Oklahoma to Maine (Ref 21).

The difference in elevation between mountaintop and valley in East Tennessee causes a considerable variation in temperature. The mean annual temperature of East Tennessee, based upon records from Chattanooga, Knoxville, and Bristol is between 57 and 58 F. Temperature extremes of -32 F in Johnson City and 111 F in Blount County have been recorded. July is the hottest month and January is the coldest. The usual date of the last killing frost ranges from March 30 in Hamilton County to May 10 in Johnson and Carter Counties. The usual date of the first killing frost ranges from October 5 in Johnson and Carter Counties to October 30 in Hamilton County. The growing season varies from 150 to 210 days, depending upon latitude and elevation.

Precipitation in East Tennessee is controlled in part by topography. It is heavier on the Cumberland Plateau and in the Unaka Mountains than in the Valley and Ridge province. Moist air masses reach the Valley and Ridge province comparatively dry because, in passing over the mountain on either side, their moisture is condensed and precipitated. Rainfall is well distributed in the study area throughout the year. Knoxville's wettest months are January, February, and March (averaging 4.66, 4.51, and 5.05 inches, respectively) and the driest are September, October, and November (averaging 2.68, 2.62, and 3.07 inches, respectively). Snow occurs only occasionally and lightly in the lowland or valley land, and usually melts within a few hours or days except in shaded areas or near the tops of some of the highest ridges. The 2-year 24-hour rainfall is 3.2 inches (Ref 36).

The topography largely controls the prevailing wind direction. The prevailing winds are from the northeast (15% of the time) and the southwest (12% of the time), but they are relatively light (mean speed is approximately 7.5 mph). Calm conditions exist 11% of the time (Ref 38).

2.2 Site Description

Smokey Mountain Smelters Site consists of a partially barren and partially wooded 29-acre property, which contains the remains of an inactive (Ref 50, Ref 51) secondary aluminum smelter (Ref 6) and an inactive fertilizer factory (Ref 20; Ref 21, page 251; Appendix 1, Book 1819, page 689). The Site is accessible from Maryville Pike via Caleb Ave. and a paved driveway with a locked gate. The pavement ends soon after the facility entrance.

The Smokey Mountain Smelters Site, as observed during numerous inspections by TDOR beginning in 1997, consists of one large industrial process building and numerous waste piles located on parts of three parcels of real estate. The property (Property Maps, Figures 2A,B,C) totals approximately 29.3 acres (see Property Maps and Details Reports, Appendix 1), ranging in elevation from 890 to 940 feet. The large building is approximately 100 feet wide, 300 feet long, and 50 feet high (Ref 20). It houses two natural gas fired rotary furnaces, one casting furnace, a large overhead crane, and provided dry storage for raw materials. Large air ducts lead to two outside baghouses near the southwest corner of the building. A portion of the north and east walls of the building has collapsed. Features outlying the main building include a small transformer area to the north, a burned office building or house across a paved driveway with truck scales farther to the north, a concrete building foundation to the northeast, two curious jumbled concrete slabs farther to the northeast, Site railroad tracks and a related building to the east, a 25 feet by 100 feet lagoon holding water to the southeast, a maintenance building to the south, and numerous gray-colored waste piles covering most of the remaining property to the south.

The east, south, and west fringes of the Site are heavily vegetated. The majority of the Site, comprised of the manufacturing operations areas and the waste piles, is lightly vegetated.

The 1942 USGS topographic map (Ref 46) shows an ordinary drainage swale at a location along the southeast side of the large building which is still presently at the Site, and a small sinkhole in the surface water pathway near the southwest property boundary; the 1966 USGS

PHOTO 1. March 28, 2002 Aerial Photograph of Smokey Mountain Smelters.

topographic map (Ref 47) shows two settling ponds in series at the head of a stream in the swale; and the 1978 USGS topographic map (Ref 48) shows the settling pond berms, but no water in the settling pond locations or in the swale. Waste piles now cover the settling pond berms. The now-buried stream channel is also shown on the soil map (Ref 35).

2.3 Operational History and Waste Characteristics

The Knoxville Fertilizer Company, a fertilizer factory utilizing a sulfuric acid tank, a 30,000 gallon water tank elevated 50 feet, a deep well, a 70,000 gallon reservoir, and a nitre house was located at the Site in February 1922 (Ref 20), and in 1948. Nitre is potassium nitrate, a crystalline salt (KNO_3) that occurs as a product of nitrification in arable soils, is a strong oxidizer, and is used especially in making gunpowder, as a fertilizer, and in medicine. An on-site or nearby (Ref 13) industrial well was named for Knoxville Fertilizer Company (Ref 21). Records indicate that American Agricultural Chemical Company owned part of the property in 1963 (Appendix 1, Book 1477, Page 424). In 1965, American Agricultural Chemical Company was merged into Continental Oil Company. Property deeds (Appendix 1, Book 1477, Pages 420-429, and Book 1523, Pages 258-262) indicate that American Agricultural Chemical Company, Continental Oil Company, and Agrico Chemical Company owned part of the Site.

The facility may have operated as a commercial agricultural chemical manufacturing facility several years ago, and could have discharged wastes to settling ponds (Ref 26, Ref 47). No information regarding the regulatory status of this Site prior to 1980 has been found. Agricultural chemical manufacturing includes establishments primarily engaged in manufacturing nitrogenous and phosphatic basic fertilizers, mixed fertilizers, pesticides, and other agricultural chemicals (Ref 19). Rock phosphate (27 - 38% P_2O_5) is the raw material source from which all types of phosphate fertilizers are produced, with the minor exception of basic slag (12 - 18% P_2O_5), which is a by-product of steel production. In its unprocessed state, rock phosphate is not suitable for direct application, since the phosphorus (P) it contains is insoluble. To transform the phosphorus into a plant-available form and to obtain a more concentrated product, phosphate rock is processed using sulphuric acid, phosphoric acid and or nitric acid. Acidulation by means of sulphuric acid produces either phosphoric acid, an intermediate product in the production of triple superphosphate (TSP), MAP, DAP and complex fertilizers, or single superphosphate (SSP). Acidulation using phosphoric acid produces TSP, and acidulation using nitric acid produces NP slurries for use in the manufacture of complex fertilizers (Ref 3).

Smokey Mountain Smelters, a.k.a. Rotary Furnace, Inc., of 1455 [SIC] Maryville Pike, was established in 1979 (Ref 32, Ref 50). In September 1979 David A. Witherspoon, Jr. and Daniel E. Johnson purchased several tracts of the Site's property (Appendix 1, Book 1691, Page 646). Mr. Johnson submitted the 1455 street number to the Knox County Department of Air Pollution Control (KCDAPC) on a permit application (Ref 6), and KCDAPC always referred to the facility's address as 1455 Maryville Pike thereafter. Smokey Mountain Smelters, Inc., 1455 Maryville Pike (Ref 50), was issued the ID # TND098071061 by the U.S. EPA Office of Air and Radiation. The 1455 Maryville Pike address may be an error on the aluminum smelter air contaminant source application. A contaminant source is not known to exist at 1455 Maryville Pike. Smokey Mountain Smelters, 1508 Maryville Pike, Knox County, Tennessee, 37920, was assigned the identification number of TN0002318277 by the U.S. EPA (Ref 44).

The Knox County Department of Air Pollution Control received numerous complaints (Ref 2, Ref 10) about the facility, performed many inspections, and cited many violations (Ref 8, Ref 10).

In 1983, the TN Division of Solid Waste Management intended to issue a Notice of Violation for operating a landfill without a permit (Ref 24). A geologic evaluation of the Site concluded that the Site was unsuitable for use as an industrial landfill (Ref 25, Ref 26). One estimate of the waste generation rate was 90-120 cubic yards per week (Ref 27) approved as a special waste for disposal at a permitted solid waste disposal facility. It is unknown if any of this waste was ever taken to a permitted solid waste disposal facility. Much of the waste was dumped on-site, and some of this may have been buried (Ref 7, Ref 1). The dump historically had an ammonia odor, was not fenced in on all sides, and often was burning (Ref 7, Ref 8).

The facility was entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), with August 6, 1997, as the discovery date (Ref 14). On the basis of data and information contained in the 1998 Preliminary Assessment of the Site, the Agency for Toxic Substances and Disease Registry (ATSDR) assessed the

public health impact of environmental contamination, stating that further site evaluation is warranted as additional information becomes available (Ref 40). The ATSDR's Health Consultation Report contained the following conclusions and recommendations:

CONCLUSIONS

1) Based on limited data, the concentrations of contaminants detected in on-site, solid waste materials do not pose a public health hazard under current site conditions.

2) Information is not available to assess the potential impact of site-related contamination on groundwater and ambient air quality in the area.

3) The unstable condition of the industrial process building poses a physical hazard to trespassers.

RECOMMENDATIONS

1) Further characterize the extent and nature of the on-site and possible off-site contamination.

2) Investigate the potential impact of contamination on groundwater quality in the area. This should include a survey of private well use in the area.

3) Investigate the potential impact of contamination on ambient air quality in the area.

4) Restrict public access to the industrial process building.

The Site Investigation Report for the Smokey Mountain Smelters Site was issued in November 1998, concluding that the Site has the potential to be placed on the National Priorities List (NPL).

Raw materials for the secondary aluminum smelter included aluminum dross; the product was aluminum ingot (Ref 50). Scrap aluminum was a raw material. Records from the office of the facility indicated that "pot pads" were processed at this facility (Ref 16A, pages 10, 11-13, 15-17, 19, 21, 42). In the primary production of aluminum, pot pads are generated inside of and in contact with spent potliners. Spent potliners are listed Hazardous Wastes, designated as K088. Other raw materials included aluminum pot bottoms and similar materials, bath pads (pot bottoms and bath pads are also generated inside of and in contact with spent potliners), and crushed material containing "non processible" carbon, iron, cryolite (Na_3AlF_6), dust, etc. (Ref 16A). Sometimes there were agreements that Smokey Mountain Smelters did not own these materials, but that ownership was exclusively by the generator of these materials. Raw materials also included aluminum scrap (Ref 18), hood pads, crushed materials, etc., and may have included any material that contained some aluminum. Large blocks of black, carbon-like materials, some of which is stored inside the building, bear a resemblance to spent anode or cathode materials from primary aluminum production. Such materials might contain some amount of recoverable aluminum. Unprocessed raw materials may now be present at the Site. Unapproved materials were sometimes charged to the rotary furnaces (Ref 10).

Numerous records were obtained from the office at Smokey Mountain Smelters (SMS). These records indicate that between 1985 and 1992 (Ref 16A, pages 5-19,21) a primary aluminum production facility in the nearby city of Alcoa, TN, sent large quantities of their materials to the Site, and that large quantities of hazardous substances and other contaminants, derived from materials that had been sent by the primary aluminum facility, are still present at the Site. Records indicate that these materials included process oily scalper chips, furnace bottoms, magnetic separator accumulations, tabular balls, selee filters, south ingot furnace bottoms, mold line floor sweepings, can rec skim, and miscellaneous materials from north plant ingot (Ref 16A, pages 24-33), and bath pads, scrap aluminum, crushed material, and pot pads (Ref 16A, pages 40-45), and bricks and non processible bath, concrete, lancing rods, trash, steel, carbon, iron, cryolite, dust, pallets, etc. (Ref 16A, pages 4-22). An associated aluminum facility in Newburgh, IN, may have also sent filter drains and ingot slabs to SMS (Ref 16A, pages 34-37). Another associated aluminum facility in Badin, NC, sent pot pads (Ref 16A, page 15). These records indicate that only a fraction of these materials were processed and only a fraction of the processed materials were recovered as aluminum alloy (aluminum containing other substances) and returned to the primary aluminum production facility or the associated facilities. The unrecovered materials included saltcake and other residues resulting from the processing of materials, which were known to require proper handling and disposal to protect the environment (Ref 16A, pages 38-39).

A letter of inquiry to SMS, dated 05-09-91, regarding SMS's handling and disposal of saltcake and other residues resulting from the processing of an aluminum production facility's skim and or scrap (Ref 16A, pages 38-39), was followed by an agreement for SMS to receive payment for the disposal of saltcake residue material generated from certain materials at an off-site landfill (Ref 16A, pages 46-49). The available records indicate that a primary aluminum production facility was invoiced by SMS for at least two, but no more, occurrences of off-site disposal of a limited amount of waste (Ref 16A, pages50-54).

A Uniform Commercial Code-Financing Statement (Ref 16A, pages 55,56) signed by the Bailor-Secured Party (a potentially responsible party, but not SMS) and the Bailee-Debtor: Smokey Mountain Smelters states, in part, the following:

> "This financing statement covers...aluminum pot bottoms and similar materials. Secured Party is the owner of all such items insofar as Debtor is merely a bailee and has no rights in such materials or the proceeds or products thereof except as a bailee."

A Bailment and Security Agreement (Ref 16A, pages 57-60) dated 04-18-80 and signed by the Bailor-Secured Party (a potentially responsible party, but not SMS) and the Bailee-Debtor: Smokey Mountain Smelters states, in part, the following:

> "Whereas, it is the desire and intention of the parties that such materials and goods and all products, final or intermediate, made therefrom, shall remain at all times the exclusive property of the Bailor-Secured Party..."

PHOTO 2. October 6, 2004. Baghouses and fallen smokestacks.

Numerous records between 1982 and 1995 (Ref 16A, pages 11-14, 20,22) indicate that this potentially responsible party sent large quantities of their materials to the Site, and that large quantities of hazardous substances and other contaminants still owned by this potentially responsible party (Ref 10,11,12) are still present at the Site.

Wastes included baghouse dust and dross residues. For every 1 million pounds of scrap processed, 760,000 pounds of secondary aluminum is produced, and 240,000 pounds of dross residues, and 3,000 pounds of baghouse dusts are generated. The dross residues contain extremely corrosive and water-soluble salts (Ref 41) containing aluminum nitride, sodium and potassium chlorides, heavy metals and other potential contaminants. Salt cake in water emits toxic and explosive gases such as hydrogen, ammonia, methane, phosphine, acetylene, hydrogen cyanide, and hydrogen sulfide. Baghouse dusts may contain Cd and Pb above the limits of the EPA Toxicity Characteristics Leaching Procedure (TCLP) test. Lithium and fluoride compounds may be present due to the use of lithium carbonate, aluminum fluoride, and cryolite (Na_3AlF_6) in aluminum production (Ref 5).

Large, black, carbon-like blocks which may bear a resemblance to anode or cathode wastes from aluminum production were observed at the Site during numerous inspections by the TDOR beginning in 1997. Baghouses and baghouse dust from secondary aluminum smelting and casting are present. Dross and slag (Ref 5) from aluminum production is present. Other

wastes, or constituents thereof, are expected to be present. Unapproved materials were sometimes charged to the rotary furnaces (Ref 10).

An ammonia odor coming from the waste mixture is often noticeable. The presence of ammonia in the atmosphere has been measured. The atmospheric reactions of trace ammonia gases are known to include formation of ammonium sulfate and oxidation to nitrate (Ref 49). Inhalation of ammonia can cause irritation of the eyes, nose, and throat (Ref 39). "Smelt" is the inflected form of "smelled", implying odorous, gaseous emissions. Smokey Mountain Smelters, 1508 Maryville Pike, was primarily engaged in recovering aluminum and alloys from new and used scrap and dross (Ref 26) using a gas-fired rotary furnace, and was classified as a secondary aluminum smelter, SIC 3341 (Ref 19), and a potential air contaminant source (Ref 9) that could emit hazardous air pollutants including 2,3,7,8-tetrachlorodibenzo-p-dioxin (Ref 42). Operations continued until at least April 1995 (Ref 16A).

Materials at the Brantley Landfill, KYD980501019, Green River Disposal, Inc., KYD980501076, and Ft. Hartford Coal Co. Stone Quarry, KYD980844625, may have similarities to the materials found at Smokey Mountain Smelters (Ref 16). The Brantley Landfill, Green River Disposal, Inc., and Ft. Hartford Coal Co. Stone Quarry were placed on the NPL. Other sites with potentially similar materials may include Red River Aluminum, AR0000605322, Bens Run Recycling Consolidate Aluminum, WVD988774626, American Resource Recovery, WID988584033, Primary Recovery Corporation, KYD119100071, Reynolds Metals Co, NYD002245967, Mideast Aluminum, NJD001775626, and Gettysburg Foundry, PAD003009362.

The Brantley Landfill contains 250,000 tons of aluminum dross. The dross contains heavy metals (including barium, cadmium, chromium, lead, copper, and manganese) and reacts violently with water to form several gases, including ammonia.

3.0 WASTE/SOURCE SAMPLING

3.1 Sample Locations

Six waste samples were collected during September 2002. These sample locations are shown in Figure 3B. These sample descriptions are summarized in Table 1. Four of these samples were collected from waste piles inside the process building. The other two samples were collected from wastes located outside the process building. One baghouse dust sample was collected from several containers located under the two baghouses located outside the process building. One ash sample was collected from a fallen smokestack at one of the baghouses. No other waste samples were collected outside the building.

Other waste source samples, not including contaminated sediment soil samples were collected in October 1997, August 1998, March 2001, and October 2004. The locations and descriptions of these ten waste samples are indicated in the Preliminary Assessment Report, the Site Inspection Report, or Figure 3C (leachate spring location), and are briefly described in Tables 2 and 2A. Three of these samples were collected from waste piles inside the process building. One sample was collected from baghouse dust located outside the process building

in several containers located under the two baghouses. Four samples were collected from waste piles outside the process building. The other two samples were collected from a leachate spring at the point of exit from a waste pile, indicated on Figure 3C. Discoloration of the receiving stream caused by the leachate is shown in Photo 2.

PHOTO 3. 12:45 pm, October 6, 2004. East East Branch of Flenniken Branch immediately after the confluence with a stream containing leachate from waste at the Smokey Mountain Smelters Site. Location of Phase 2 samples SW-11 and SW-19. Flow is from right to left.

3.2 Analytical Results

Waste sample toxicity tests, analytical results, requests, and chain-of-custody information are presented in Appendix 2 and summarized in Tables 2 and 2A, "Waste Analytical Data Summary".

The analytical results of waste samples indicated the presence of several hazardous substances. The observed release criteria were satisfied for all detected classical/nutrient, inorganic, extractable organic, and volatile organic substances. The most observed releases occurred for inorganics. High values of aluminum were found in the wastes, as would be expected. Chromium, lead, and pesticides were found at potentially RCRA-characteristically-toxic levels. When requested, ammonia was reported to be present in all waste samples collected in previous inspections. Previous inspection has revealed pesticide compounds in soil near the building and high values of pesticide compounds in the waste piles near the old settling ponds. Evidence suggests that an agricultural chemical manufacturing facility may have discharged wastes to settlings ponds that were later covered with aluminum smelting wastes. The concentration of pesticide compounds on the surface of waste piles away from the old settling ponds was expected, and found, to be low.

TABLE 1 - SAMPLE CODES, TYPES, LOCATIONS, and JUSTIFICATIONS

SMOKEY MOUNTAIN SMELTERS - EXPANDED SITE INSPECTION - PHASE I

SAMPLE TYPE	SAMPLE ID	LOCATION	JUSTIFICATION
WASTE	01	Baghouse Dust	release
	02	Material at Smokestack	release
	03	Floor Inside Building	release
	04	South Waste Pile Inside Building	release
	05	North Waste Pile Inside Building	release
	06	Northwest Waste Pile Inside Building	release
SOIL/ SEDIMENT	01	Background at Mt. Olive Road	background
	02	Lagoon Branch, Upstream of the Lagoon and near Railroad Tracks	background
	03	Railroad Branch D S of railroad, U S of Site	background
	04	Toe of Fill Area near well and leachate	release
	05	East East Fork D S of SMS Branch	release
	06	East East Fork D S of SMS Branch and SD-05	release
	07	East East Fork (after SWRO from Landfill, tracks, and Screen Arts Volunteer Equipment) U S of Road at Fill Area	release
	08	West East Fork	background
	09	East Fork D S of West East Branch	release
	10	Mayo Branch	background
	11	East Fork D S of Mayo Branch	release
	12	Flenniken Branch near Maloney Road residences in Cul-de-sac	release
	12D	Flenniken Branch near Maloney Road residences in Cul-de-sac (duplicate)	release
	13	Lower Flenniken Branch in Embayment	release
	14	Lagoon	release
	15	Dry, on-site pond	release
GROUND WATER	01	Near and South of Location 4, 4 feet depth	release
SURFACE WATER	01	Background at Mt. Olive Road	background
	06	East East Fork D S of SMS Branch	release
	08	West East Fork	background
	09	East Fork D S of West East Fork	release
	11	East Fork D S of Mayo Branch	release
	12	Flenniken Branch near Maloney Road residences in Cul-de-sac	release
	12D	Flenniken Branch near Maloney Road residences in Cul-de-sac (duplicate)	release
	13	Lower Flenniken Branch in Embayment	release
	14	Lagoon	release

TABLE 2 - WASTE ANALYTICAL DATA SUMMARY

Smokey Mountain Smelters Expanded Site Inspection

	WA-01 BAGHOUSE DUST	WA-02 SMOKESTACK ASH	WA-03 BUILDING FLOOR	WA-04 BUILDING WASTE PILE	WA-05 BUILDING WASTE PILE	WA-06 BUILDING WASTE PILE	LW-01 LEACHATE	SW-09 LEACHATE
Inorganics Cyanide UNITS: MG KG								
CYANIDE	0.75 U	3.0	2.0	1.0 U	5.8 A	1.3	U	NA
ALUMINUM	21,000 A	[1]81,000	[1]93,000	[1,2]130,000	[1,2]120,000	[1,2]130,000	[5]2.51	NA
ANTIMONY	[2]5.2 A	[2,4]18	[2]4.2	[2]2.3	[2]1.7	1.0 U	0.015 U	NA
ARSENIC	15 U	[1,2,4]16	15 U	12 U	14 U	12 U	[5]0.012	NA
BARIUM	21 A	77	[2]140	[2]150	71	[2]110	0.11	NA
BERYLLIUM	3.0 U	1.6	1.5 U	2.4 U	[2]7.2	1.2 U	0.005 U	NA
CADMIUM	[1,4]11 A	[1,4]4	[1,4]6.1	1.0 U	1.2 U	1.0 U	0.005 U	NA
CALCIUM	3500 A	9300	16,000	10,000	31,000	4900	19.0	NA
CHROMIUM	[2]8.1 AJ	[2,4,1,2]140	[2,4]75	[2,4]69	[2,4]57	[2]36	0.01	NA
COBALT	4.9 U	11	5.7	4.1	2.6	2.8	0.764	NA
COPPER	[4]450 A	[4]810	[4]1400	[4]600	[4]570	[4]410	[5]2.79	NA
IRON	9400 AJ	[1,2]200,000	[1]45,000	4700	6400	1600	0.927	NA
LEAD	[1,4,1,2]230A	[2,4,1,2]110	[2,4,1,2]110	[4]39	[4]37	15	[5]0.016	NA
MAGNESIUM	7900 A	8300	7400	7900	4000	4200	16.0	NA
MANGANESE	200 A	[1]4400	560	390	330	57	[5]0.317	NA
TOTAL MERCURY	[4]1A	[4]1.4 A	[4]0.17	0.098 U	0.096 U	0.096 U	0.0002 U	NA
MOLYBDENUM	9.8 U	22	19	8.2 U	4.7 U	4.1 U	NA	NA
NICKEL	[2,4]130 A	[2,4]220	[2,4]450	[2,4]110	[2,4]120	[2,4]160	[5]0.688	NA
POTASSIUM	7700 A	940 U	1000 U	56,000	21,000	25,000	1320	NA
SELENIUM	4.9 U	[2]11	5.0 U	4.1 U	4.7 U	4.1 U	0.01 U	NA
SILVER	20 U	9.4 U	10 U	16 U	9.4 U	8.2 U	0.005 U	NA
SODIUM	320,000A	10,000	1800	110,000	89,000	72,000	18,500	NA
STRONTIUM	10 A	54	81	34	120	31	NA	NA
THALLIUM	1.2 U	1.2 U	1.2 U	1.0 U	1.2 U	1.0 U	[5]0.03	NA
TIN	20 U	26	22	24	9.4 U	16	NA	NA
TITANIUM	55 A	380	460	1000	390	1000	NA	NA
VANADIUM	5.7 U	40	28	35	34	29	0.021	NA
YTTRIUM	3.0 U	1.4 U	2.0	2.4 U	1.8	1.2 U	NA	NA
ZINC	[2,4]9200 A	[2,4]1100	[2,4]1600	[4]490	[4]410	[4]130	[5]0.802	NA
Extractable Organic Compounds UNITS: MG KG								
ACENAPHTHYLENE (L)	1.0 U	0.3 J	1.2 U	NA	NA	NA	0.01 U	NA
ANTHRACENE (L)	1.0 U	[4]1.4	1.2 U	NA	NA	NA	0.01 U	NA
BENZALDEHYDE	1.0U	0.14 J	1.2 U	NA	NA	NA	0.02 U	NA
BENZO(A)ANTHRACENE (H)	[2]0.22 J	[1,2,4]7.4	1.2 U	NA	NA	NA	0.01 U	NA
BENZO(B)FLUORANTHENE (H)	[1,4]1 J	[1,2,4]19	1.2 U	NA	NA	NA	0.01 U	NA
BENZO(GHI)PERYLENE (H)	[4]1.9 J	[4]1.6	1.2 U	NA	NA	NA	0.04 U	NA
BENZO(K)FLUORANTHENE (H)	[1,4]1 J	[1,4]18	1.2 U	NA	NA	NA	0.01 U	NA
BENZO-A-PYRENE (H)	[1,2]0.42 J	[1,2,4]12	1.2 U	NA	NA	NA	0.01 U	NA
BIS(2-ETHYLHEXYL) PHTHALATE	1.0 U	[4]1.8	1.2 U	NA	NA	NA	0.02 U	NA
CARBAZOLE	1.0 U	[2]0.47 J	1.2 U	NA	NA	NA	0.01 U	NA
CHRYSENE (H)	[4]0.63J	[2,4]35	1.2 U	NA	NA	NA	0.01 U	NA
DIBENZO(A,H)ANTHRACENE (H)	[1,2]0.24J	1.2 U	1.2 U	NA	NA	NA	0.04 U	NA
DIBENZOFURAN	1.0 U	0.26 J	1.2 U	NA	NA	NA	0.01 U	NA
FLUORANTHENE (H)	[4]0.85J	[4]43	0.19 J	NA	NA	NA	0.01 U	NA
INDENO (1,2,3-CD) PYRENE (H)	[1,4]1.6	[1,2,4]2.3	1.2 U	NA	NA	NA	0.04 U	NA
NAPHTHALENE (L)	1.0 U	0.13 J	1.2 U	NA	NA	NA	0.0042 J	NA
4-NITROPHENOL	1.0 U	2.5 U	1.2 U	NA	NA	NA	0.0678 J	NA
PHENANTHRENE (L)	[4]0.53J	[4]15	0.14 J	NA	NA	NA	0.01 U	NA
PHENOL	1.0 U	1.2 U	1.2 U	NA	NA	NA	0.145	NA
PYRENE (H)	[4]0.45J	[4]14	0.14 J	NA	NA	NA	0.01 U	NA
Pesticide PCB Compounds UNITS: MG KG								
GAMMA-CHLORDANE /2	0.01 U	0.15 U	[4]0.0034 J	NA	NA	NA	XU	NA
Volatile Organic Compounds UNITS: MG KG								
ETHYLBENZENE	0.002 U	0.0024 U	0.0015 UJ	NA	NA	NA	0.0003 J	NA
BENZENE	0.0015 J	0.0024 U	0.0015 UJ	NA	NA	NA	0.0025 U	NA
CHLOROMETHANE	0.0058 J	0.0024 JA	0.0015 UJ	NA	NA	NA	0.005 U	NA
TOLUENE	0.0022	0.0024 UJ	0.0015 UJ	NA	NA	NA	0.0011 J	NA
1,2,4-TRIMETHYLBENZENE	0.0015 J	0.0024 UJ	0.0015 UJ	NA	NA	NA	NR	NA
m&p XYLENE	0.0041 U	0.0047 UJ	0.0030 UJ	NA	NA	NA	0.0004 J	NA

TAL/TCL parameters not listed were not detected in any of these waste samples. L - low molecular weight PNA H - high molecular weight PNA

Superscripts indicate possible exceedance of a criteria of concern (see Appendix 4 - Criteria of Concern).

Data Qualifiers: A-Average value NA-Not analyzed J-Estimated value U-Material was analyzed for but not detected /2 Constituents or metabolites of technical chlordane + -Surrogate recovery low

(CONTINUED ON NEXT PAGE)

TABLE 2 - WASTE ANALYTICAL DATA SUMMARY (CONTINUED)

Smokey Mountain Smelters Expanded Site Inspection

	WA-01 EARTHEN DUCT	WA-02 SMOKESTACK	WA-03 BLDG FLOOR	WA-04 BLDG WASTE PILE	WA-05 BLDG WASTE PILE	WA-06 ELEC WASTE PILE	LW-01 LEACHATE [illegible]	SW-0[illegible] LEACHATE [illegible]
Classicals Nutrients UNITS: MG KG, or as indicated								
CYANIDE	0.75 U	3	2	2	5.8 A	1.3	0.02 U	NA
AMMONIA, NH_3	NA	NA	NA	NA	NA	NA	[b]730	[b]27.5
CHLORIDE, Cl^-	NA	NA	NA	NA	NA	NA	[b]39,350	[b]11,700
DISSOLVED RESIDUE	NA	NA	NA	NA	NA	NA	55,040	22,300
FLUORIDE, F^-	NA	NA	NA	NA	NA	NA	244	NA
NITRATE NITROGEN	NA	NA	NA	NA	NA	NA	18	-
NITRITE NITROGEN	NA	NA	NA	NA	NA	NA	15	-
NO_3 & NO_2 NITROGEN	NA	NA	NA	NA	NA	NA	34	2.2
pH, SU	NA	NA	NA	NA	NA	NA	[b]9.4	[b]9.37
SPECIFIC CONDUCTIVITY, µMHO	NA	NA	NA	NA	NA	NA	56,244	34,700
SULFATE, $SO_4^=$	NA	NA	NA	NA	NA	NA	811	24
TEMPERATURE, °C	NA	NA	NA	NA	NA	NA	15.4	19.2
TURBIDITY, NTU	NA	NA	NA	NA	NA	NA	2.55	16.59
AQUATIC TOXICITY	-	-	-	-	-	-	LC_{50}=<1.56	-

Superscript indicate possible exceedance of criteria of concern (see Appendix 4 - Criteria of Concern)

Data Qualifier: A-Average value NA-Not analyzed U-Material was analyzed for but not detected

TABLE 2A - WASTE ANALYTICAL DATA SUMMARY

1998 Smokey Mountain Smelters Site Inspection

	WA-01 BLUE 10-97	WA-02 BAGHOUSE 10-97	WA-03 BLDG PILE 10-97	WA-04 OUT SIDE 10-97	WA-05 MNTN SHED 08-98	WA-06 MNTN SHED 08-98	WA-07 FURNACE 08-98	WA-08 BLD FLOOR 08-98
Inorganics UNITS: MG KG								
ALUMINUM	96,700	65,500	88,800	135,000	8200	48,900	113,000	74,600
AMMONIA	331	1026	132	135	36.7	49.3	2530	5290
ANTIMONY	13	9	5	9	13.0	9.6	9.4	3.5
ARSENIC	6	6	7	11	9.8	7.2	8.8	7.1
BARIUM	52	30	111	222	86	94	446	95
BERYLLIUM	1 U	1 U	2	1	2	3	3	4
CADMIUM	0.5 U	15.6	0.5 U	1.4	3.2	2.8	4.6	1.3
CALCIUM	5630	11400	5850	9680	22600	21500	13800	31800
CHROMIUM	79	6	52	93	46	107	72	112
COBALT	3	4	6	13	9	66	11	8
COPPER	42,900	754	1080	576	1690	1970	1380	634
CYANIDE	1.0 U	1.0 U	1.0 U	1.0 U	1.22	1.0 U	1.0 U	1.0 U
IRON	9920	4860	14,800	15,400	12,400	15,000	29,500	14,100
LEAD	291	129	53	96	100	85	213	36
MAGNESIUM	5410	24600	9060	8240	8710	8820	11800	7130
MANGANESE	384	144	388	339	500	486	673	434
MERCURY	0.1 U	0.73	0.1 U	0.1 U	0.12	0.11	0.1 U	0.1 U
NICKEL	240	551	169	326	776	745	695	379
POTASSIUM	695	4230	15000	5250	1290	1320	145	232
SELENIUM	8	2	1	2	5.5	6.0	6.9	2.7
SILVER	2	1	1 U	1 U	1	1	1 U	1 U
SODIUM	17,100	107,000	47,400	9880	6910	5920	19,100	28,100
THALLIUM	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
VANADIUM	38	20 U	49	76	43	46	53	53
ZINC	2330	4020	1350	1140	906	803	1050	549
Extractable Organic Compounds UNITS: MG KG								
BIS(2-ETHYLHEXYL)PHTHALATE	0.477J	0.541	0.572	0.46 U	0.246B	0.322B	2.370	0.304B
DIETHYL PHTHALATE	0.157BJ	0.23 U	0.2 U	0.125BJ	0.135B	0.457B	2.710	0.137B
BENZ(A)ANTHRACENE	0.25 U	0.239	0.2 U	0.23 U	0.13 U	0.13 U	0.0697	0.045 U
BENZO(A)PYRENE	0.25 U	0.609	0.2 U	0.23 U	0.13 U	0.13 U	0.0556	0.045 U
BENZO(B)FLUORANTHENE	0.25 U	1.440	0.2 U	0.23 U	0.130	0.148	0.143	0.0507
BENZO(GHI)PERYLENE	0.5 U	2.100	0.41 U	0.46 U	0.53 U	0.54 U	0.0937J	0.18 U
BENZO(K)FLUORANTHENE	0.25U	0.279	0.2 U	0.23 U	0.13 U	0.13 U	0.0448	0.045 U
FLUORANTHENE	0.13 U	0.396	0.1 U	0.12 U	0.0397J	0.0537J	0.195	0.0761
INDENO(1,2,3-CD)PYRENE	1.30 U	2.170	1.0 U	1.2 U	0.13 U	0.54 U	0.108J	0.18 U
PHENANTHRENE	0.13 U	0.143	0.0799J	0.12 U	0.13 U	0.13 U	0.0796	0.0534
PYRENE	0.13 U	0.288	0.1 U	0.12 U	0.13 U	0.13 U	0.155	0.0562
CHRYSENE	0.25 U	0.408	0.2 U	0.23 U	0.13 U	0.13 U	0.138	0.0299J
Pesticide PCB Compounds UNITS: MG KG								
ALDRIN	0.007U	0.0064U	0.01 U	0.0062U	0.0076U	0.0065U	0.0043U	0.00226J
ALPHA-CHLORDANE	0.0097U	0.0088U	0.014U	0.0086U	0.489	0.249	0.0059U	0.00333
GAMMA-CHLORDANE	0.007U	0.0063U	0.01U	0.0062U	3.450	1.980	0.0042U	0.00383
DIELDRIN	0.0073U	0.0066U	0.011U	0.0065U	0.280	0.183	0.0044U	0.005 U
HEPTACHLOR	0.0086U	0.0078U	0.013U	0.0077U	3.110	1.210	0.0053U	0.003 U
HEPTACHLOR EPOXIDE	0.0091U	0.0083U	0.014U	0.0081U	0.499	0.371	0.0056U	0.0031U
Volatile Organic Compounds UNITS: MG KG								
ACETONE	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U	0.065
BENZENE	0.0025U	0.0008J	0.0025U	0.0025U	0.0025U	0.0025U	0.0025U	U
CHLOROMETHANE	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.0019J	U
METHYLENE CHLORIDE	0.0025U	0.0025U	0.0025U	0.0025U	0.0098B	0.0097B	0.033B	0.027B
TOLUENE	0.0014J	0.0036	0.0023	0.0047	0.0008J	0.0048	0.011	0.0005J

TAL/TCL parameters not listed were not detected in any SI waste samples.

Superscripts indicate possible exceedance of a criteria of concern (see Appendix 4, "Criteria of Concern")).

Data Qualifiers: A-Average value. B-analyte in blank as well as sample. J-Estimated value. U-Material was analyzed for but not detected.

Photo 4 (top) Outside waste pile. Looking to the south past the maintenance building. February 5, 2002.

Photo 5 (below) Waste pile inside the west end of the process building. February 5, 2002.

Waste analyses indicated several exceedances of several criteria of concern. Most of the 14 solid waste samples had high levels of aluminum, antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc. Leachate contained several substances at concentrations expected to be acutely or chronically toxic to aquatic life. Laboratory methods for measuring the acute toxicity of the leachate to freshwater organisms indicated the extreme acute toxicity of LC_{50} 1.56% (at least 50% (actually 100%) lethal to freshwater organisms at less than 1.56% effluent concentration). Bisphenol A, a known endocrine disruptor, was tentatively identified in leachate.

3.3 Conclusions

Wastes containing CERCLA hazardous substances related to secondary aluminum smelting and agricultural chemical operations are present in waste piles covering much of the Site. Large quantities of all substances detected in wastes may have been managed and disposed of at the Site for many years, and some may be buried (Ref 1). Buried wastes, if present, were not investigated during this ESI. Subsurface wastes, if present, may not be adequately characterized.

Other waste characteristics may require applicable or relevant and appropriate Clean Water Act (CWA) standards for the leachate discharge including, but not necessarily limited to, standards for pH, temperature, chlorides, dissolved residue, and ammonia.[1]

4.0 GROUND WATER PATHWAY

4.1 Hydrogeologic Setting

The Smokey Mountain Smelters Site is located in the Valley and Ridge physiographic province and the nonglaciated central region hydrogeologic setting. Numerous ridges and intervening valleys characterize the land surface in the Valley and Ridge physiographic region, all trending in the northeast-southwest direction. This orientation is the result of folding and fracturing (Ref 21). Elevations in the area of the facility range between 813 (slightly lower during Fort Loudoun Reservoir drawdown) and 1160 (Rodgers Ridge) feet above mean sea level (Figure 4, Site Plan). On-site elevation ranges from 890 to 940 feet. A detailed geologic map is presented as Figure 5.

The rocks underlying the area of the Site are Middle Ordovician Ottosee shale. This formation is characterized by extensive Karst development (Ref 21). Groundwater within formations of this group is restricted to fractures. The numerous fractures that have been created through the folding and faulting experienced by these formations are largely interconnected. The groundwater yield ranges from small to moderate quantities of water to wells and springs.

[1] CWA regulations that are most likely to be ARARs at Superfund sites are standards governing direct discharges to surface waters, indirect discharges to publicly owned treatment works (POTWs), and discharges of dredge-and-fill materials into U.S. waters. The CWA controls the direct discharge of pollutants to surface waters through the National Pollutant Discharge Elimination System (NPDES) program (CWA §402), which contains both substantive and administrative standards that may be ARARs. Potentially applicable substantive NPDES standards include technology-based pollutant controls, or effluent standards, governing surface water discharges. A NPDES effluent control technology, could, for example, be applicable to the discharge of a treated CERCLA wastewater to any surface water. Administrative NPDES standards, such as permit and certification requirements, are applicable to CERCLA discharges to off-site surface water. CERCLA response actions frequently trigger administrative NPDES standards, because only surface water that is within or in very close proximity to an AOC is considered on site. The NPDES program also includes ambient water quality standards that could be relevant and appropriate to CERCLA discharges, depending on the designated and potential uses of affected surface waters, and other factors (§300.430(e)(2)(i)(e)). Ambient water quality standards include federal water quality criteria (FWQC) and state water quality standards (WQS), which set concentrations of pollutants considered adequate to protect surface waters for various uses, and state antidegradation standards, designed to protect existing uses of waters and maintain water quality.

The Cambrian-Ordovician Carbonate aquifer (recently renamed the Valley and Ridge aquifer) consists of extensively folded and faulted carbonate, sandstone, and shale of Cambrian and Ordovician age underlying the Valley and Ridge physiographic province. The rock formations crop out alternately in long, narrow belts, so that aquifer characteristics show marked areal variability. The ridges range in altitude from about 1,500 to over 7,000 feet above sea level; valleys generally range between 750 and 1,000 feet above sea level. Generally regolith is thin over the shales and sandstones and thick over the limestone. The sandstone and shale units are poor aquifers; nearly all the high producing wells and springs are in the dolomitic limestone formations, particularly the upper formations of the Knox Group (Mascot and Kingsport). The Knox aquifer is frequently singled out as a separate aquifer. Water moves through solution-enlarged fractures, which in areas may form extensive networks. The folding and faulting has produced regional anisotropy in aquifer hydraulic properties, and ground water may move preferentially in strike-parallel or strike-normal directions. Well yields commonly range from 5 to 200 gal min. (Ref 31A)

The Knoxville Fertilizer Company's on-site well was installed in a water-bearing limestone bed in the Oh geologic horizon and yielded 100 gpm (Ref 21).

4.2 Groundwater Targets

It is estimated that the amount of groundwater used in the Knoxville area exceeds 10 million gallons per day (Ref 21). There are numerous records of nearby water wells (Ref 21, Ref 29, Ref 30, Ref 31). The 1990 Census revealed that in the Knoxville Metropolitan Statistical Area there were 2.56 persons per occupied housing unit (Ref 34). The 1990 Census revealed that in Knox County, individual wells were the source of water for 6026 housing units. This amounts to 15,400 persons, in the entire county, or, proportionally, approximately 1500 in the 4 miles radius, or 50.3 square miles, study area (Ref 11).

The 1995 U. S. Geological Survey National Water-Use Data Files lists 19,570 population served by publicly-supplied ground water and 47,660 self-supplied population by ground-water withdrawals for domestic water use in the 1340 square mile Watts Bar Lake hydrologic unit, HUC8Code 06010201. The 1995 U. S. Geological Survey National Water-Use Data Files lists 19,570 population served by publicly-supplied ground water and 47,660 self-supplied population by ground-water withdrawals for domestic water use (Ref 48A) in the 1340 square mile (Ref 48b) Watts Bar Lake hydrologic unit area, HUC8Code 06010201. The total population supplied by groundwater is 67,230 in the Watts Bar Lake hydrologic unit area.

Proportioned by area, by distance category, the following groundwater use target populations, within a four-mile radius of Smokey Mountain Smelters, have been estimated as shown in the following table.

4.3 Sample Locations

One sample of on-site groundwater was collected from a depth of 4 feet below ground level. The location of the sample is shown on Figures 4A and 4C. The field documentation and GPS and geographic coordinates for the well location are contained in Appendix 3.

ESTIMATEDGROUNDWATER USE TARGET POPULATIONS		
distance category	area	target populations
0 to ¼ mile	0.196 square miles	10
¼ to ½	0.589	30
½ to 1	2.36	118
1 to 2	9.42	473
2 to 3	15.7	788
3 to 4	22.0	1104
0 to 4	50.3	2524

4.4 Analytical Results

The groundwater sample analytical results, requests, and chain-of-custody information are presented in Appendix 2 and summarized in Table 3, "Groundwater Analytical Data Summary". No background sample was collected.

The analytical results of the groundwater sample indicated the presence of several hazardous substances. Primary drinking water contaminants detected in wastes and found above primary drinking water maximum contaminant levels in groundwater included antimony and arsenic. Pentachlorophenol was not detected in wastes, but was found above the primary drinking water maximum contaminant level. Ammonia, detected in all waste samples in previous inspections, was detected in the groundwater sample at a level exceeding the Draft Health Advisory for Drinking Water Contaminants (Ref 43).

All metals (except cadmium) detected in wastes in concentrations exceeding the soil screening levels for migration to groundwater were found in the groundwater.

Dieldrin was not detected in waste samples collected during this inspection, but was detected in on-site sediment soil and has been detected in previously collected waste samples during the 1998 Site Inspection. Dieldrin was detected in groundwater above the health advisory level. Secondary Drinking Water Standards were exceeded for aluminum, iron, and manganese. These contaminants were found in wastes.

4.5 Groundwater Conclusions

A release of contaminants to groundwater from on-site wastes and contaminated soils is indicated by analytical data. On-site disposal of commercial agricultural and aluminum smelting wastes in an uncontained manner on permeable soil in a Karst region of shallow ground water has occurred. Heavy precipitation occurs in the area. An unlined on-site lagoon contains contaminated water and sediment that poses a threat to groundwater quality. The subsurface is permeable. There are several drinking water wells in the area. Ammonia, metal, and organic contaminants found in wastes are mobile in groundwater. All metals (except cadmium) detected in wastes in concentrations exceeding the soil screening levels for migration to groundwater were found in the groundwater. Since there is usage of groundwater resources in the area of the Site, remediation and further investigation is warranted.

TABLE 3
GROUNDWATER ANALYTICAL DATA SUMMARY
Smokey Mountain Smelters Expanded Site Inspection

Inorganics		
ALUMINUM	8400	J
AMMONIA	550,000	
ANTIMONY	9.3	R
ARSENIC	200	
BARIUM	200	J
CALCIUM	4800	
CHROMIUM	18	
COBALT	5.3	
COPPER	33	
IRON	1800	
LEAD	11	
MAGNESIUM	610	
MANGANESE	85	J
NICKEL	39	
POTASSIUM	970,000	J
SELENIUM	41	
SODIUM	1.2E+07	
TOTAL MERCURY	0.5	
VANADIUM	45	
ZINC	38	
Extractable Organic Compounds		
(3-AND/OR 4-)METHYLPHENOL	4	J
2-METHYLPHENOL	4	J
ACETOPHENONE	2	J
ACETOPHENONE, 4'-HYDROXY-	26	NJ
BENZALDEHYDE, 4-HDYROXY-3,5-	4	NJ
BENZENEACETIC ACID	15	NJ
BENZOIC ACID, 4-HYDROXY-3-ME	41	NJ
CAPROLACTAM	2	J
NAPHTHALENE	3	J
PENTACHLOROPHENOL	5	J
PHENOL	190	
PHENOL, 2- (1-METHYLETHYL)-	6	NJ
Pesticide/PCB Compounds		
DIELDRIN	0.27	J
Volatile Organic Compounds		
(M- AND/OR P-)XYLENE	0.69	J
ACETONE	45	J
METHYL ISOBUTYL KETONE	3.6	J
TOLUENE	0.89	J

UNITS: µg/kg D=draft L=listed for regulation T=tentative (not officially proposed)
T+L TCL parameters not listed were not detected in this sample
Superscripts indicate possible exceedance of a criteria of concern (see Appendix 4 - Criteria of Concern)
Data Qualifiers: J=Estimated Value N=Presumptive evidence of presence of material
R=QC indicates that data unusable. Compound may or may not be present. Resampling and reanalysis is necessary for verification

Further investigation should include evaluation of all applicable criteria, including, but not necessarily limited to, Bisphenol A, Chloride, Fluoride, Nitrate, Nitrite, Total Nitrate & Nitrite, Sulfate, and Total Dissolved Solids, and other substances, whether alone or in combination with other substances, that are toxic, carcinogenic, mutagenic or teratogenic, other than those of natural origin, which may pose an unreasonable risk to the public health (Ref 26).

PHOTO 6. April 22, 2004. The on-site lagoon, looking south.

5.0 SURFACE WATER PATHWAY

5.1 Hydrologic Setting

The probable points of entry (PPE) of overland flow from all sources at the Smokey Mountain Smelters Site are along an intermittent stream that flows from the on-site lagoon, the first PPE, then along the edge of the waste piles toward the unnamed tributary of Flenniken Branch (Figure 4) called the East East Fork in this Report. This on-site stream was formerly located where there are now waste piles (Ref 47, Ref 35). The present intermittent flow channel is shown in Figure 3C and a portion of it is labeled SMS Branch, which is formed by flows from the Lagoon Branch and the Railroad Branch. The Lagoon Branch flows through the lagoon. Rainfall runoff from both on-site and off-site flows to the on-site lagoon, which is impounded on at least one side by waste piles. In numerous inspections, the lagoon has not been observed to be dry, nor has the water level been observed to fluctuate significantly, thus, the lagoon is likely to be spring-fed. The Railroad Branch is believed to convey only off-site and a very small area of on-site rainfall runoff.

Formerly, surface water flowed from on-site settling ponds across the Site as an unnamed tributary of Flenniken Branch (Ref 47, Ref 35) before the on-site stream and ponds were partially covered with waste and/or soil (Ref 1, Ref 48). The waste piles have covered a small stream (Ref 47, Ref 35) and contaminants have migrated into other nearby, downstream surface waters (Tables 4,5,6) as far as lower Flenniken Branch (1.6 miles distant) where analysis of sediment indicates potential adverse impact. The 15.0-mile surface water pathway begins here and extends to the Tennessee River (Fort Loudoun Lake) at river mile 637.5 and downstream to Mile 625.3.

The general direction of overland flow from the Site is to the south and southwest to the East East Fork of Flenniken Branch. The first one and seven-tenths mile of the 15.0-mile surface water pathway includes other unnamed tributaries of Flenniken Branch and the lower main channel of the stream named Flenniken Branch (Ref 47, Ref 48), which are all classified for Fish and Aquatic Life, Recreation, Irrigation, and Livestock Watering and Wildlife by the State of Tennessee (Ref 28). The last thirteen and three-tenths miles of the 15.0-mile surface water pathway is one and one-tenth mile of the Knob Creek/Flenniken Branch embayment of the Tennessee River (Fort Loudoun Lake) and twelve and two-tenths miles of the Tennessee River (Fort Loudoun Lake) from River Mile 637.5 to 625.3, where annual mean

streamflow is estimated to be approximately 14,000 cubic feet per second (Ref 48C). It is classified for Domestic Water Supply, Industrial Water Supply, Fish and Aquatic Life, Recreation, Irrigation, Livestock Watering and Wildlife, and Navigation by the State of Tennessee (Ref 28). The Knob Creek Flenniken Branch embayment of the Tennessee River (Fort Loudoun Lake) is adjacent to the I.C. King County Park, a designated recreation area with automobile access, parking, a boat launch ramp, a fishing pier, a bike and hiking trail, picnic area, etc.

The largest bulk of visible waste within the Site boundaries is not in the 100-year flood insurance zone (Ref 4), nor is it believed to be in a 500-year flood zone. The 2-year 24-hour rainfall is 3.2 inches (Ref 36). Mean annual precipitation is 55 inches. Waste constituents are expected to migrate due to any rainfall that migrates from the waste piles.

The Flenniken Branch drainage area is approximately 1790 acres. To evaluate this watershed area, it was divided into sub-watersheds (Ref 23), and the 15.0-mile surface water pathway was divided into sections dependent on flow characteristics, use classifications, sample locations, etc. Five additional background sections were established.

Silty loam is the predominant soil along the buried stream channel (Ref 35). Site soil types identified by the Soil Conservation Service on Figure 6 include Armuchee and Litz soil materials (GE), Leadvale and Whitesburg silt loams undulating phases (LD), Lindside silt loam (LG), and Sequoia silty clay loam eroded rolling phase (SK). A general description of the soil types is provided in the Knox County Soil Survey.

5.2 Surface Water Targets

Fort Loudoun Reservoir is surrounded by private and commercial development and is used extensively for fishing and other aquatic recreations. The most commonly harvested fish species are largemouth, smallmouth, and white bass, along with bluegill and white and black crappie (Ref 33).

There are many surface water targets along the 15.0-mile surface water pathway from the Smokey Mountain Smelters Site. These targets include users of 13.3 miles of the Tennessee River (Fort Loudoun Lake) fishery and recreation areas, the fishery portion of the remaining 1.7-mile surface water pathway, numerous wetland areas (Figure 7 - Wetlands Maps), wildlife (Ref 22), and livestock.

The I.C. King County Park partially surrounds the Knob Creek Flenniken Branch embayment. A boat launch, automobile access to both sides of the embayment, and a hiking biking trail around a portion of the embayment is provided to the public. The automobile access on one side of the Knob Creek Flenniken Branch embayment also provides access to the lower Flenniken Branch watershed. An unrestricted railway along one side of Flenniken Branch (Figure 4) enhances foot access to the lower Flenniken Branch watershed, which is also accessible by small watercraft.

5.2.1 Public Drinking Water Intakes

There is no permitted public drinking water intake along the 15.0-mile surface water pathway associated with the Site. Two springs in the second half-mile of the surface water pathway could be attractive to organisms that may prefer spring water. A structure is built over a portion of the first spring. The last 13.3 miles of the 15.0-mile surface water pathway is classified for Domestic Water Supply (Ref 28).

5.2.2 Fisheries

The 13.3-mile portion of the Tennessee River (Fort Loudoun Lake) in the 15.0-mile surface water pathway associated with the Site is classified for Fish and Aquatic Life (Ref 28) and is used extensively for fishing (Ref 33). The most commonly harvested fish species are

POUNDS PER YEAR - FT. LOUDOUN RESERVOIR-1993 (REF 33: TWRA 1993)

SPECIES	ESTIMATED NUMBER HARVESTED	MEAN WEIGHT	TOTAL WEIGHT PER SPECIES
WHITE CRAPPIE	3519.06	0.69	2428.15
BLACK CRAPPIE	359.90	0.56	201.54
LARGEMOUTH BASS	2879.23	1.87	5384.16
SMALLMOUTH BASS	999.73	2.70	2699.27
YELLOW BASS	159.96	0.24	38.39
BLUEGILL	7957.88	0.18	1432.42
FLATHEAD CATFISH	119.97	3.95	473.88
BLUE CATFISH	959.74	3.01	2888.82
CHANNEL CATFISH	519.80	1.86	966.94
SAUGER	39.99	1.00	39.99
DRUM	79.98	1.89	151.16
WALLEYE	39.99	1.90	75.98
YELLOW BULLHEAD	199.95	1.69	337.92
WHITE BASS	4318.85	0.58	2504.93
TOTAL WEIGHT-ALL SPECIES			**19,623.55**

Calculation of Annual Production of Selected Human Food Chain Organisms
Tennessee River Mile 637.5 to 625.3, SMOKEY MOUNTAIN SMELTERS - KNOX CO., TN

POUNDS PER YEAR ALLOCATED TO TRRM 637.5 to 625.3 (12.2 MILES) = 19623.55 x 12.2/55 = 4353 POUNDS
POUNDS PER YEAR ALLOCATION EXTRAPOLATION TO 1.1 MILES OF RESERVOIR IN THE KNOB CREEK FLENNIKEN BRANCH TRIBUTARY EMBAYMENT: 19623.55 x 1.1/55 = 392.5 POUNDS
TOTAL PRODUCTION IN 13.3 MILES OF THE SURFACE WATER PATHWAY = 4745.5 POUNDS

largemouth, smallmouth, and white bass, along with bluegill and white and black crappie. The estimated weight of fish harvested from Fort Loudoun Reservoir in 1993 was 19,600 pounds, which translates to 4750 pounds along the 13.3-mile length of surface water pathway of the reservoir associated with the Site. Evidence that the upstream, lotic portion of Flenniken Branch and some of its unnamed tributaries could be fisheries has been observed.

Estimated production of human food chain organisms within the 15.0-mile surface water pathway is summarized as follows:

Human Food Chain Fishery	Annual Consumption
KNOB CREEK FLENNIKEN BRANCH TRIBUTARY EMBAYMENT	392.5 POUNDS
TENNESSEE RIVER (FORT LOUDOUN LAKE)	4353 POUNDS

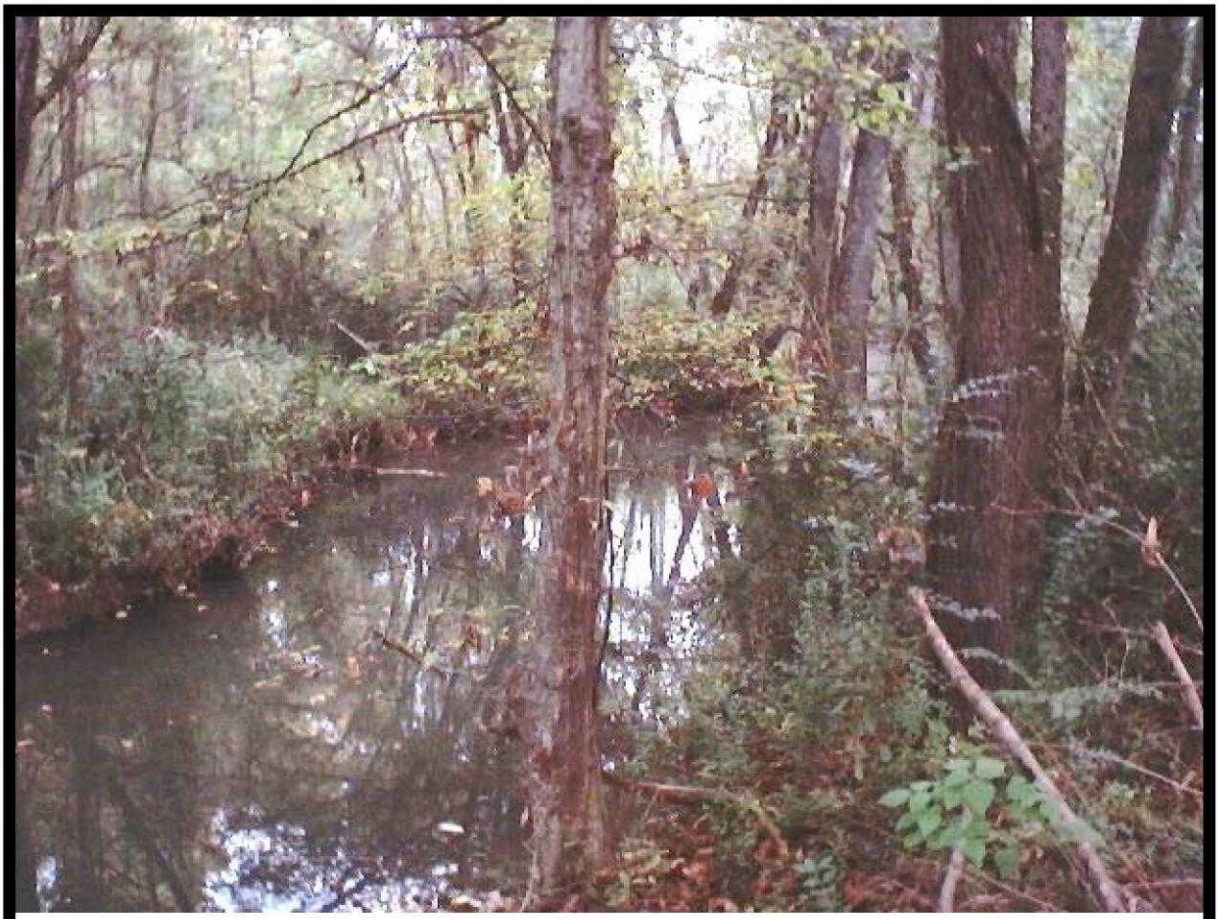


PHOTO 7. October 6, 2004.
Looking upstream at Flenniken Branch at the Knob Creek/Tennessee River embayment 1/8 mile distant from the parking lot at I.C. King Park and 1.6 mile from the Site.
Location of Phase 2 sample SW-18, collected at the surface in the middle of the channel.

5.2.3 Sensitive Environments

The sensitive environments in or adjacent to the 15.0-mile surface water pathway include several wetlands (Figures 7.8.9. and 10 - Wetlands Maps). The closest wetland appears to be approximately 1.7 mile downstream of the Site, in the Knob Creek/Flenniken Branch embayment of Fort Loudoun Lake. Thereafter, wetlands exist along most of the remaining 15.0-mile surface water pathway.

The wetland acreage along the 15.0-mile surface water pathway is estimated to be 54 acres. Wetland frontage is estimated to be 24 miles (Ref 17).

Lacustrine littoral unconsolidated bottom semipermanently flooded dIked/impounded (L2UBFh), Paulustrine forested broad-leaved deciduous temporarily flooded diked/impounded (PFO1Ah), Lacustrine littoral unconsolidated bottom permanently flooded diked/impounded (L2UBHh), and Paulustrine emergent persistent seasonally flooded diked/impounded (PEM1Ch) wetlands exist along the surface water pathway.

Endangered species and critical or sensitive habitat are as reported in the "Project review information for endangered species and critical or sensitive habitat" (Ref 22). Habitat known

to be used by Federal designated or proposed endangered or threatened species is revealed by review of this Division of Natural Heritage data base that indicates several recorded federal listed endangered species near the project boundaries in the Knox and Bearden quads, within an approximate four miles radius, where the taxon is threatened by extinction throughout all or a significant portion of its range. Documentation of exact locations of particular species is not available to the public.

The I.C. King County Park surrounds the Knob Creek Flenniken Branch embayment.

5.3 Sample Locations

For the purpose of identifying and investigating surface water quality and releases of TAL TCL hazardous substances from sources at the Site, seven aqueous and twelve sediment samples were collected from the receiving stream during Phase 1. These samples covered the surface water pathway beginning at the on-site lagoon and extending approximately 1.6 miles through residential areas to the Knob Creek Flenniken Branch embayment of Fort Loudoun Lake (Tennessee River).

In Phase 1, two background aqueous and three background sediment samples were collected from the surface water pathways in unnamed tributaries of Flenniken Branch, upstream of the surface water pathway from identified sources at the Site. Seven aqueous and eleven sediment release samples were collected.

The Phase 1 surface water and sediment sample descriptions are summarized in Table 1. Sample locations are shown in Figures 4A-D and schematic representations of the locations are presented in Tables 4 and 5. The GPS and geographic coordinates for sample locations are listed in Appendix 3. These samples were collected during the dry season at a time when rainfall had been below normal for many days (Ref 37), so that there was no surface hydraulic connection between the Site and the receiving surface water stream, and there was no leachate flow on the surface. Several planned aqueous surface water samples were not collected due to the low flow condition in the driest month of the year.

Because of the known presence of several non-TAL TCL contaminants in wastes that could impact surface water quality and threaten human health or the environment, a Phase 2 surface water inspection was planned (Ref 23) and conducted after Phase 1. In Phase 2, field determinations were made for conductivity, pH, temperature, and turbidity. Analytical results were requested for alkalinity, chloride, conductivity, dissolved residue, suspended residue, total residue, sulfate, ammonia, NO_3 & NO_2 nitrogen, and total phosphorus.

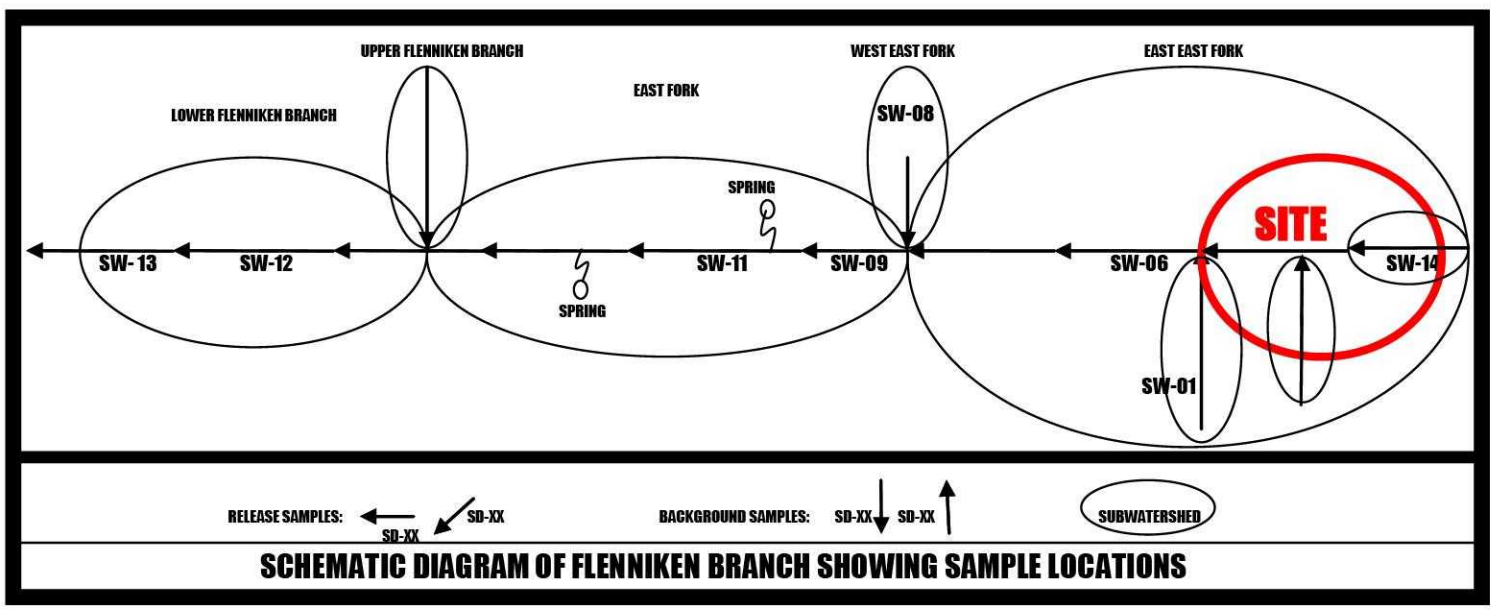
In Phase 2, eight aqueous samples were collected from the receiving stream. These samples covered the surface water pathway beginning at the on-site lagoon and extending approximately 1.6 miles through residential areas to the lentic thalweg of the Flenniken Branch embayment of Fort Loudoun Lake (Tennessee River), where the stream was marginally wadeable. Four background aqueous samples were collected from the surface water pathways in each of the flowing unnamed tributaries of Flenniken Branch and from upper Flenniken Branch, upstream of the surface water pathway from identified sources at the Site. There was no surface hydraulic connection between water in the lagoon and downgradient surface waters. Surface water flow beginning at the leachate spring was

TABLE 4 - SURFACE WATER ANALYTICAL DATA SUMMARY
SMOKEY MOUNTAIN SMELTERS - EXPANDED SITE INSPECTION - PHASE I

Sample ID And Type: Background/Release		SW-01 B	SW-08 B	SW-14 R	SW-06 R	SW-09 R	SW-11 R	SW-12 R	SW-12D R	SW-13 R
Sample Collection Sequence	team 1		7			8(2nd day)	5	1	2	4
	TEAM 2	3		9(2nd day)	6					
Distance Rank Of Release Samples				0	1	2	3	4	4	5
Metals										
ALUMINUM		470 UJ	420 UJ	[6]270,000 J	[6]3500 J	670 UJ	320 UJ	270 UJ	270 UJ	340 UJ
ANTIMONY		3.9 U	3.9 U	11	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U	3.9 U
ARSENIC		3.2 U	3.2 U	[58]56	[58]22	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
BARIUM		27J	67J	640 J	130J	70 J	110 J	70 J	70 J	76 J
BERYLLIUM		0.2 U	0.2 U	5.4	0.33 U	0.2 U	0.52 U	0.22 U	0.22 U	0.2 U
CADMIUM		0.6 U	0.6 U	[6]21	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
CALCIUM		58,000	160,000	84,000	45,000	160,000	250,000	130,000	140,000	150,000
CHROMIUM		1.1 U	1.1 U	[6]140	2.8	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
COBALT		1.0 U	1.0 U	43	5.7	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
COPPER		1.1 U	1.8	[6]6800	6.6	1.2	1.1 U	1.1 U	1.1	1.1 U
IRON		600	330	[6]68,000	[6]15,000	800	55	31 J	36	270
LEAD		2.6 U	2.6 U	[6]170	[6]6.5	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U
MAGNESIUM		5100	14,000	29,000	4800	14,000	21,000	11,000	12,000	12,000
MANGANESE		150 J	79 J	[8]4900 J	[8]8900 J	130 J	60 J	48 J	60 J	170 J
TOTAL MERCURY		0.1 U	0.1 U	0.27	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
NICKEL		2.0 U	2.0 U	[6]870	4.2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
POTASSIUM		970 UJ	1600 J	400,000 J	19,000 J	1700 J	4000 J	1700 J	1900 J	2100 J
SELENIUM		3.2 U	3.2 U	[6]9.9	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
SILVER		1.2 U	1.2 U	5.7	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
SODIUM		2900 U	47,000	2,100,000	250,000	48,000	350,000	100,000	140,000	140,000
THALLIUM		4.9 U	4.9 U	6.4 R	[8]7.3	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U
VANADIUM		1.1 R	1.2	120	7.4	1.1 R	1.0 U	1.0 U	1.0 U	1.0 U
ZINC		3.4	2.1	[6]2700	24	2.2	2	2.2	2.7	4.2
Extractable Organic Compounds										
ACETOPHENONE		10 U	10 U	6J	11 U	10 U	11 U	10 U	10 U	11 U
Pesticide/PCB Compounds										
4,4'-DDT (P,P'-DDT)		0.1 U	0.1 U	0.18 NJ	U	0.1 U	0.11 U	0.1 U	0.1 U	0.11 U
ALDRIN		0.050 U	0.051 U	0.085 NJ	0.056 U	0.051 U	0.054 U	0.05 U	0.05 U	0.054 U
DIELDRIN		0.10 U	0.1 U	0.22 J	0.11 U	0.1 U	0.11 U	0.1 U	0.1 U	0.11 U
Volatile Organic Compounds										
ACETONE		25. U	25. U	25. U	26. J	25. U	25. U	25. U	25. U	25. U
METHYL ETHYL KETONE		12. U	12. U	12. U	9.6 J	12. U	12. U	12. U	12. U	12. U
TETRACHLOROETHENE		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.83 AJ	0.89 J	0.80 J
TOLUENE		1.0 U	1.0 U	1.0 U	3.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

units: ug/l TAL/TCL parameters not listed were not detected in any aqueous surface water samples. BHM032205
Superscripts indicate possible exceedance of a criteria of concern (see Appendix 4, "Criteria of Concern")).
A-Average value. J-Estimated value. N-Presumptive evidence of presence of material. NR-Not Reported.
U-Material was analyzed for but not detected. R-QC indicates that data unusable. Compound may or may not be present. Resampling and reanalysis is necessary for verification.

OBSERVED RELEASE



SCHEMATIC DIAGRAM OF FLENNIKEN BRANCH SHOWING SAMPLE LOCATIONS

observed to be continuous throughout the approximate 1.8-mile reach of the surface water inspection pathway, from the leachate spring to the Flenniken Branch Embayment. The aqueous surface water sample, SW-09, was determined to consist of only leachate from a waste pile, and, thus, is also a waste sample. Five other major subwatersheds were identified and inspected during the sampling event, but samples were not collected because there was no flow into the surface water pathway from identified sources at the Site.

SD-15 was a sediment sample collected from a dry, on-site pond. It was evaluated as an investigation of the pond contents and soil characteristics and not as a contributor to the surface water pathway evaluation.

5.4 Analytical Results

The aqueous surface water sample analytical results, requests, and chain-of-custody information from Phase 1 are presented in Appendix 2 and summarized in Table 4, "Surface Water Analytical Data Summary". The sediment/soil analytical results, requests, and chain-of-custody information from Phase 1 are presented in Appendix 2 and summarized in Table 5, "Sediment Analytical Results". The Phase 2 surface water sample descriptions and locations are summarized in Table 6. All sample analytical results, requests, and chain-of-custody information for Phase 2 samples are in Appendix 2.

The analytical results of the surface water and sediment samples indicated the release of several hazardous substances to the surface water pathway. Observed releases to the surface water pathway have been established by direct observation. A leachate seep from a waste pile was seen entering the stream during leachate sample collection events on March 6, 2001, and October 6, 2004. The leachate samples showed that the leachate contained hazardous substances associated with the waste piles. The leachate samples were taken from the leachate stream before it mixed with other surface water. Observed releases to surface water include all detected parameters in the leachate samples. These leachate sample results are summarized in Table 2A.

Observed releases in both water and sediment/soil were indicated for Aluminum, Copper, Sodium, Zinc, Cadmium, Nickel, and Toluene.

Numerous observed released hazardous metal contaminants in water that exceeded some criteria of concern were found in the two samples closest to the Site, but none in the more distant samples, however, numerous water quality criteria were exceeded for non-TAL/TCL parameters in most of the samples for which these analyses were requested. These parameters include some or all of the following:

Alkalinity	pH	Residue, Total
Ammonia	Phosphorus, Total	Sulfate
Chloride	Residue, Dissolved	Temperature
Conductivity	Residue, Suspended	Turbidity
Nitrogen, NO_3& NO_2		

TABLE 5 - SEDIMENT/SOIL ANALYTICAL DATA SUMMARY

SMOKEY MOUNTAIN SMELTERS - EXPANDED SITE INSPECTION - PHASE I

Sample ID and Type: Background/Release	SD-01 B	SD-08 B	SD-10 B	SD-14 R	SD-02 B	SD-03 B	SD-15 R	SD-04 R	SD-05 R	SD-06 R	SD-07 R	SD-09 R	SD-11 R	SD-12 R	SD-12D R	SD-13 R
Sample Collection Sequence team 1		12	5								10	13(2nd day)	7	1	2	4
Sample Collection Sequence team 2	3			11	12	14(2nd day)	15(2nd day)	6	8	9						
Distance Rank of Release Samples				0	0	0	0	0	1	2	3	4	5	6	6	7
comparison to background SAMPLE #				1	10	10	10	1	1	1	1	1/8	1/8	1/8	1/8	1/8
METALS / CYANIDE mg/kg																
ALUMINUM	7800 J	13,000 J	4600 J	100,000[12]A	12,000 J	9700 J	15,000	29,000 J	38,000 J	7900 J	11,000 J	11,000 J	7600 J	11,000 J	11,000 J	3400 J
ANTIMONY	2.5 UJ	2.0 UJ	0.92 UJ	0.72[3] AJ	1.0 UJ	0.93 UJ	0.25 U	1.3 UJ	0.97 UJ	1.1 UJ	0.93 UJ	1.7 UJ	1.3 UJ	1.1 UJ	1.1 UJ	1.4 UJ
ARSENIC	12[1234]	16[1234]	8.4[1234]	5.0[123] A	25[1234]	18[1234]	9.5[1234]	12[1234]	13[1234]	14[1234]	8.7[1234]	12[1234]	11[1234]	18[1234]	22[1234]	5[123]
BARIUM	50	82[3]	33	160[3] A	120[3]	76	69	42	90[3]	63	76	63	49	67	190[3]	18
BERYLLIUM	0.84	1.3	0.54	2.3 A	1.1	1	1.2	0.94	1.4	1	0.8	0.96	0.83	1.4	1.7	0.43
CADMIUM	0.39 U	0.30 U	0.30 U	9.6[134] A	1.6[34]	0.24 U	2[134]	0.36 U	5.1[134]	0.17 U	4.0[134]	0.63 U	0.54 U	0.16 U	0.16 U	0.40 U
CALCIUM	6900	13,000	1700	25,000 A	9100	4000	4600	2200	24,000	1200	22,000	8600	9200	6500	14,000	4500
CHROMIUM	12[3]	22[3]	13[3]	53[34] A	23[3]	15[3]	20[3]	26[3]	42[3]	12[3]	33[3]	17[3]	21[3]	61[34]	58[34]	10[3]
COBALT	9.8	17	8.6	14 A	15	13	13	10	11	10	14	13	13	29	35	4.9
COPPER	21[4]	24[4]	9.1	2700[4] A	49[4]	28[4]	99[4]	560[4]	430[4]	10	200[4]	66[4]	29[4]	150[4]	85[4]	16
IRON	28,000[1]	43,000[1]	18,000	22,000 A	31,000[1]	28,000[1]	31,000[1]	24,000[1]	30,000[1]	27,000[1]	28,000[1]	32,000[1]	28,000[1]	58,000[1]	64,000[1]	12,000
LEAD	43[4] J	39[4] J	16 J	71[4] A	130[4] J	29 J	55[4]	31[4] J	44[4] J	12 J	87[4] J	49[4] J	28 J	52[4] J	49[4] J	15 J
MAGNESIUM	980	1400	500	6200 A	1200	1200	1500	1700	5100	570	3000	1000	1200	1300	3400	470
MANGANESE	440	1900[1]	550	1800[1] A	3400[1]	920	500	580	1100	1000	1900[1]	1700	1300	1800[1]	3400[1]	220
TOTAL MERCURY	0.16 U	0.12 U	0.06 U	0.13[4] A	0.10 U	0.06 U	0.10	0.08 U	0.06 U	0.07 U	0.08 U	0.13 U	0.08 U	0.07 U	0.07 U	0.09 U
MOLYBDENUM	NR	NR	NR	4.9 U	NR	NR	1.3	NR	NR	NR	NR	NR	NR	NR	NR	NR
NICKEL	7.6[3]	12[3]	5.6	340[34] A	17[34]	14[3]	26[34]	110[34]	170[34]	10[3]	26[34]	67[34]	11[3]	11[3]	13[3]	3.7
POTASSIUM	740 J	980 J	380 J	4200 A	1000 J	870 J	1800	2300 J	1500 J	780 J	900 J	730 J	530 J	480 J	500 J	280 J
SELENIUM	3.8[3] J	2.4 UJ	0.76 UJ	0.98 UJ	2.9[3] J	1.1 UJ	0.99 U	1.1 U	0.85 UJ	1.1 UJ	0.76 UJ	1.4 UJ	1.4 UJ	1.9[3] J	1.4[3] J	1.2 UJ
SILVER	1.1	1.6	0.72	9.8 U	1.1	1.0	2.0 U	1.3	0.9	0.97	1.4	1.7	1.1 R	2.2[3]	2.4[3]	0.72
SODIUM	1000	1400	510	8700 A	1200	810	250	16,000	4800	990	1900	1100 J	1100	1700	1600	520
STRONTIUM	NR	NR	NR	61 A	NR	NR	15	NR	NR	NR	NR	NR	NR	NR	NR	NR
THALLIUM	3.2	1.2 U	1.6 U	0.40 U	2.7 J	2.2 U	0.50 U	1.6 U	2.1 U	1.6 U	3.7 U	2.2 U	2.7 U	4.3 J	4.6	1.8 U
TIN	NR	NR	NR	11 A	NR	NR	2.0 U	NR	NR	NR	NR	NR	NR	NR	NR	NR
TITANIUM	NR	NR	NR	190 A	NR	NR	12	NR	NR	NR	NR	NR	NR	NR	NR	NR
VANADIUM	22	32	11	43 A	26	19	25	28	37	17	20	23	16	35	36	8.3
YTTRIUM	NR	NR	NR	5.6 A	NR	NR	19	NR	NR	NR	NR	NR	NR	NR	NR	NR
ZINC	97	75	42	1000[34] A	380[4]	140[4]	260[4]	220[4]	1400[34]	26	620[34]	120	91	520[4]	400[4]	59
CYANIDE	0.48UJ	0.38 UJ	0.18 UJ	0.69U	0.87 J	0.18 UJ	0.75U	1.0 J	0.59 UJ	0.21 UJ	0.28 UJ	0.33UJ	0.24UJ	0.21UJ	0.22UJ	0.27UJ
EXTRACTABLE ORGANIC COMPOUNDS µg/kg																
BENZALDEHYDE	190 J	90 J	380 UJ	1800 U	160 J	2000 UJ	120 J	570 UJ	400 UJ	450 UJ	2000 UJ	720 UJ	530 UJ	400 UJ	410 UJ	500 UJ
PHENOL	740 U	730 U	380 U	1800 U	420 U	1900 U	1000 U	570 U	400 U	450 U	2000U	720 U	530 U	400 U	4 10 U	500 U
ACENAPHTHYLENE	740 UJ	730 UJ	380 UJ	1800 U	130 J	290 J	1000 U	570 UJ	400 UJ	450 UJ	2000 UJ	720 UJ	530 UJ	400 UJ	410 UJ	500 UJ
PHENANTHRENE	740 U	730 U	380 U	1800 U	68 J	320 J	130 J	570 U	400 U	450 U	2000 U	720 U	530 U	400 U	410 U	54 J
ANTHRACENE	740 U	730 UJ	380 UJ	1800 U	110 J	270 J	1000 U	570 UJ	400 UJ	450 UJ	2000 UJ	720 UJ	530 UJ	400 UJ	410 UJ	500 UJ
CARBAZOLE	740 U	730 U	380	1800 U	49 J	1900 U	1000 U	570 U	400 U	450 U	2000 U	720 U	530 U	400 U	410 U	500 U
FLUORANTHENE	300 J	160 J	380 UR	1800 U	[4]340 J	[4]1900 J	480[4] J	570 UR	400 UR	450 UR	2000 UR	98 J	530 UR	84 J	70 J	100 J
PYRENE	200 J	110 J	380 UJ	1800 U	300 J	[4]1400 J	350[4] J	570 UJ	400 UJ	450 UJ	2000 UJ	73 J	530 UJ	58 J	53 J	73 J
BENZO(A)-ANTHRACENE	210 J	730 UJ	380 UR	1800 U	280 J	[4]1600 J	220 J	570 UR	400 UR	450 UR	2000 UR	720 U	530 UR	400 UR	410 UR	500 UR
CHRYSENE	280 J	96 J	380 UR	1800 U	[4]450 J	[4]1900 J	320 J	570 UR	400 UR	450 UR	2000 UR	80 J	530 UR	51 J	47 J	69 J
BEHP	740 U	170 J	380 U	1800 U	530 U	1900 U	1000 U	570 U	64 J	450 U	2000 U	720 U	530 U	400 U	410 U	120 J
BENZO(B)-FLUORANTHENE	320 J	84 J	380 U	1800 U	730	1700 J	330 J	570 U	400 U	450 U	2000 U	76 J	530 U	400 U	410 U	51 J
BENZO(K)-FLUORANTHENE	260 J	730 U	380 UJ	1800 U	430 J	1100 J	260 J	570 UR	400 UJ	450 UR	2000 UJ	7200 J	530 UJ	81 J	410 UJ	500 UJ
BENZO-A-PYRENE	270 J	77 J	380 U	1800 U	[4]400 J	[4]1400 J	290 J	570 UR	400 U	450 U	2000 U	720 U	530 U	400 U	410 U	50 J
INDENO (1,2,3-CD)-PYRENE	190 J	730 UR	380 UR	1800 U	330 J	950 J	140 J	570 U	400 UR	450 UR	2000 UR	720 UR	530 UR	400 UR	410 UR	500 UJ
BENZO(GHI)PERYLENE	200 J	730 U	380 U	1800 U	310 J	910 J	160 J	570 U	400 U	450 U	2000 U	720 U	530 U	400 U	410 U	52 J
PESTICIDE/PCB COMPOUNDS µg/kg																
4,4'-DDT (P,P'-DDT)	7.4 U	7.3 U	3.8 U	44 U	4.2 U	3.9 U	26 U	5.8 U	4.0 U	4.6 U	216[4]	11[4]	5.3 U	4.1 U	4.1 U	4.9 U
ALDRIN	3.8 U	3.8 U	2.0 U	24 U	2.2 U	2.0 U	10 U	3.0 U	2.1 U	4.4	6.0	3.6 U	2.7 U	2.1 U	2.1 U	2.5 U
DIELDRIN	7.4 U	7.3 U	3.8 U	18 U	4.2 U	3.9 U	15 U	21[34]	9.8[34]	4.6 U	30[134]	7.1 U	5.3 U	4.1 U	4.1 U	4.9 U
ALPHA-CHLORDANE /2	3.8 U	3.8 U	2.0 U	18 U	2.2 U	2.0 U	20 U	3.0 U	2.1 U	2.4 U	2.0 U	3.7[4]	2.7 U	2.1 U	2.1 U	2.5 U
ENDRIN ALDEHYDE	7.4 U	7.3 U	3.8 U	NR	4.2 U	3.9 U	NR	5.8 U	4.0 U	4.6 U	8.7	9.6	5.3 U	4.1 U	4.1 U	4.9 U
ENDRIN KETONE	7.4 U	7.3 U	3.8 U	44 U	4.8	6.0 U	26 U	5.8 U	4.0 U	4.6 U	3.9 U	7.1 U	5.3 U	4.1 U	4.1 U	4.9 U
GAMMA-CHLORDANE /2	3.8 U	3.8[4]	2.0 U	18 U	2.2 U	2.0 U	4.7[4]J	3.0 U	2.1 U	2.4 U	2.0 U	3.6 U	2.7 U	2.1 U	2.1 U	2.5 U
METHOXYCHLOR	38 U	38 U	20 U	88 U	22 U	20 U	22 J	30 U	21 U	24 U	20 U	36 U	27 U	21 U	21 U	25 U
PCB-1260 (AROCLOR 1260)	74 U	73 U	38 U	220 U	42 U	39 U	260 U	58 U	40 U	46 U	200[4]	250[14]	86[4]	41 U	41 U	49 U
VOLATILE ORGANIC COMPOUNDS µg/kg																
P-ISOPROPYLTOLUENE	3.9 U	3.9 U	1.0 U	4.8 J	2.6 UJ	1.8 UJ	2.7 UJ	1.5 AJ	1.7 U	1.1 U	1.1 U	5.0 U	3.2 U	1.1 U	1.1 U	1.4 U
1,3,5-TRIMETHYLBENZENE	3.9 U	3.9 U	1.0 U	28.	2.6 UJ	1.8 UJ	2.7 UJ	1.6 U	1.7 U	1.1 U	1.1 U	5.0 U	3.2 U	1.1 U	1.1 U	1.4 U
TETRACHLOROETHENE	3.9 U	3.9 U	1.0 U	6.0 U	2.6 UJ	1.8 UJ	2.7 UJ	1.6 U	1.7 U	1.1 U	1.1 U	5.0 U	3.2 U	0.62 J	1.1 U	1.4 U
TOLUENE	3.3 J	3.3 J	1.0 U	6.1	2.6 UJ	1.8 UJ	2.7 UJ	1.6 U	1.7 U	1.1 U	1.1 U	5.0 U	3.2 U	1.1 U	1.1 U	0.71 J

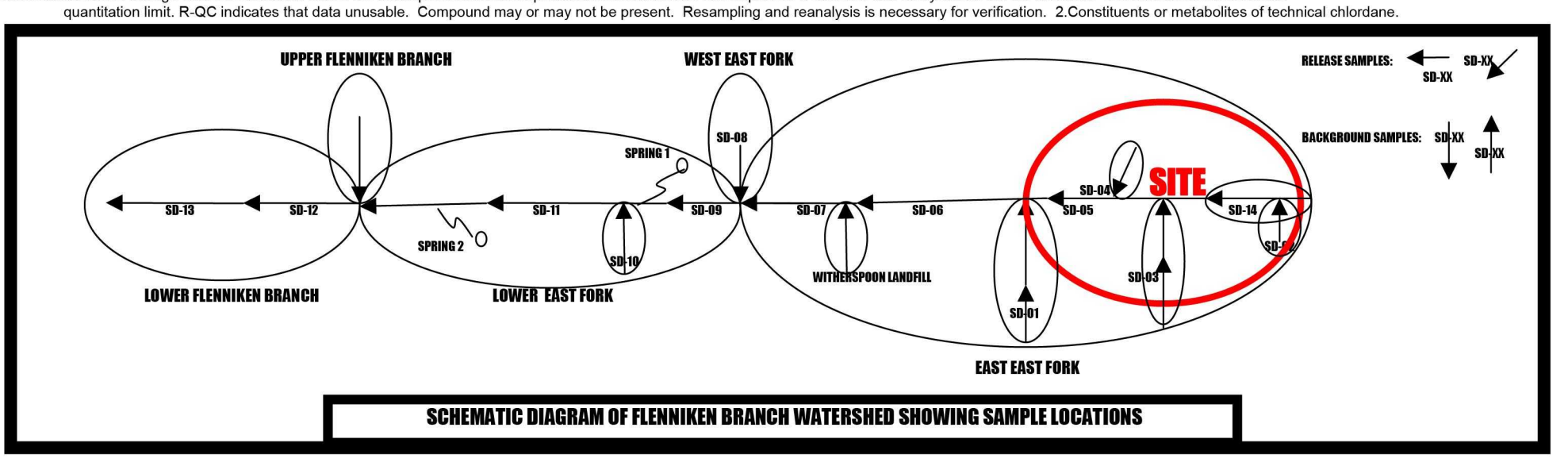
TAL/TCL parameters not listed were not detected in any sediment/soil samples.
Superscripts indicate possible exceedance of a criteria of concern (see Appendix 4, "Criteria of Concern")).

BHM032205

OBSERVED RELEASE

not attributable to sources sampled in this inspection

Data Qualifiers: A-Average value. J-Estimated value. N-Presumptive evidence of presence of material. NR-Not Reported. U-Material was analyzed for but not detected. The number is the minimum quantitation limit. R-QC indicates that data unusable. Compound may or may not be present. Resampling and reanalysis is necessary for verification. 2.Constituents or metabolites of technical chlordane.

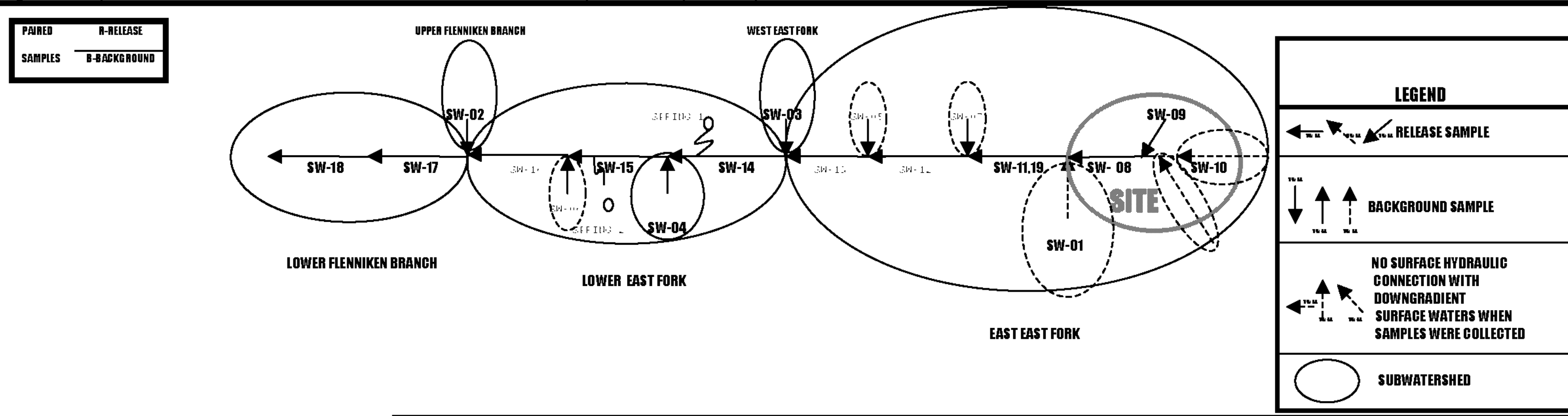


SCHEMATIC DIAGRAM OF FLENNIKEN BRANCH WATERSHED SHOWING SAMPLE LOCATIONS

TABLE 6 - SAMPLE CODES, TYPES, LOCATIONS, JUSTIFICATIONS and SURFACE WATER ANALYTICAL DATA SUMMARY

SMOKEY MOUNTAIN SMELTERS - EXPANDED SITE INSPECTION - PHASE 2 - SURFACE WATER SAMPLES COLLECTED 10-06-04

time	sequence	location/justification	sample ID and type: Bckground/ Release		distance rank of release samples	field measurements: conductivity, µS/cm	field measurements: pH, SU	field measurements: T, °C	field measurements: turbidity, NTU	alkalinity, mg/l	chloride, mg/l	conductivity, µS/cm	dissolved residue, mg/l	suspended residue, mg/l	total residue, mg/l	sulfate, mg/l	ammonia, mg/l	NO_3 & NO_2 nitrogen, mg/l	total phosphorus, mg/l
1515	13	On-site Lagoon (location is upgradient of largest visible, known leachate flow)	SW-10	R	0	766	8.53	23.1	40.00	[6]140	131	776	222	42	488	15	U	0.06	0.275
1320	11	Leachate at Southernmost Waste Pile	SW-09	R	0	36,700	[6/]9.37	19.2	16.59	[6]2990	[6]11,700	34,700	22,300	29	22,900	24	[6]27.5	2.2	0.03
1305	10	Sector 8 - SMS Leachate Stream before confluence with background stream	SW-08	R	0	36,400	[6/]9.01	15.5	5.38	[6]1790	[6]11,300	34,400	22,900	156	23,400	22	[6]28.4	5.7	0.36
1245	9	East East Fork of Flenniken Branch after confluence with SMS Fork (duplicate)	SW-19	R	1					[6]1560	[6]11,000	31,000	20,000	21	20,400	30	[6]28.6	6.6	0.34
1245	8	East East Fork of Flenniken Branch after confluence with SMS Fork	SW-11	R	1	35,700	8.84	14.5	6.35	[6]1550	[6]10,700	30,700	19,500	38	22,100	31	[6]29.5	6.5	0.42
1435	12	Sector 1 - Background	SW-01	A		265	7.26	14.6	4.77	[6]116	5	276	244	U	166	10	U	0.06	0.011
1112	6	East Fork of Flenniken Branch after discharge from Sector 3	SW-14	R	4	1280	7.87	14.8	3.18	[6]173	181	1100	644	U	662	17	0.16	1.95	U
1115	7	Sector 3 - Tributary south of Maryville Pike / West East Fork	SW-03	A		957	7.63	15.5	3.09	[6]129	133	929	560	U	555	15	U	1.92	U
1033	4	East Fork of Flenniken Branch after discharge from Sector 4	SW-15	R	5	2970	7.76	13.7	2.43	[6]164	[6]294	1560	901	U	940	20	0.03	1.29	0.018
1037	5	Sector 4 - Mayo Tributary	SW-04	A		627	8.10	13.3	3.21	[6]185	11	616	369	U	354	9	U	0.31	U
0934	2	Flenniken Branch after discharge from Sector 2	SW-17	R	7	1426	8.03	14	3.08	[6]148	[6]271	1380	801	U	810	18	U	1.95	U
0939	3	Sector 2 - Maloney Road/Flenniken Branch	SW-02	A		692	7.98	14	2.77	[6]172	75	671	398	U	385	6	U	1.15	U
0830	1	Flenniken Branch Embayment of Fort Loudoun Lake (Tennessee River)	SW-18	R	8	1341	7.85	15.0	[9]2.92	[6]142	[6,10]250	1280	[1/10]720	U	739	19	U	1.61	U
		East East Fork of Flenniken Branch after discharge from Sector 7	SW-12	R	2	NOT COLLECTED DUE TO ZERO FLOW AT ATTRIBUTION POINT													
		Sector 7 - south of L&N tracks, west of SMS	SW-07	A															
		East East Fork of Flenniken Branch after discharge from Sector 5	SW-13	R	3														
		Sector 5 - Volunteer Equipment	SW-05	A															
		East Fork of Flenniken Branch after discharge from Sector 6	SW-16	R	6														
		Sector 6 - Mt. Olive Church	SW-06	A															



Criteria of Concern		Alkalinity	Chloride	NH_3 (pH, T dependent)	pH	Phosphorus	Sulfate	Turbidity	Solids Dissolved and Salinity	Solids Suspended and Turbidity
6	Freshwater CMC[1]	-	860	0.537 (pH=[illegible]) 18.4 (pH=[illegible])	-					*
	Freshwater CCC[1]	20	230	0.305 (pH=[illegible], T=[illegible]) 5.21 (pH=[illegible], T=[illegible])	6.5-9	0.1 (elemental)				*
7	Consumption Of Water and Organism[1]				5-9				250	*
8	Consumption Of Organism Only[1]									*
9	Primary Drinking Water MCL						500 P	0.5-1.0 (PS)		
10	Secondary Drinking Water Standard		250		6.5-8.5		250		500	
11	Health Advisory (Drinking Water)			30 D			D			
RQ (pounds)				100						

The observed release criteria for chemical analysis were satisfied for several inorganic hazardous substances and toluene. Observed releases in surface water or sediment soil that were significantly above the background level are indicated in Tables 4, 5, and 6, and are listed below as follows:

Alkalinity	Cadmium	Dieldrin	Nitrogen	Selenium
Aluminum	~~Chlordane, alpha~~	Iron	NO_3& NO_2	Sodium
Ammonia	Chloride	Lead	Phosphorus, Total	Sulfate
Antimony	Chromium	Magnesium	Potassium	Thallium
Arsenic	Cobalt	Manganese	Residue, Dissolved	Toluene
Barium	Conductivity	Mercury, Total	Residue, Suspended	Vanadium
Beryllium	Copper	Nickel	Residue, Total	Zinc

Among the observed released hazardous contaminants in sediment soil that exceeded some criteria of concern were cadmium, copper, mercury, nickel, and dieldrin.

5.5 Surface Water Conclusions

A release of hazardous, and other harmful, substances to surface waters and sediments soils from on-site wastes is indicated by analytical data. These releases can be attributed to the wastes at the Site, and do not appear to be caused by any other source.[2] On-site, uncontained disposal of aluminum smelting wastes that impacts water quality has occurred. An estimated 100,000 cubic yards (Ref 15) of uncontained waste is located in an area where precipitation is sometimes heavy so that migration of waste constituents along the surface water pathway occurs. Most surface water from the Site flows as leachate to an unnamed tributary of Flenniken Branch that is on the Site, and only 1.6 miles from a heavily used fishery. Some of the detected hazardous substances are carcinogenic and some are highly bioaccumulative, persistent, and toxic.

Clean Water Act (CWA) regulations that are most likely to be applicable and relevant or appropriate requirements (ARARs) at Superfund sites are standards governing direct discharges to surface waters, indirect discharges to publicly owned treatment works (POTWs), and discharges of dredge-and-fill materials into U.S. waters. CWA controls the direct discharge of pollutants to surface waters through the National Pollutant Discharge Elimination System (NPDES) program (CWA §402), which contains both substantive and administrative standards that may be ARARs. Potentially applicable substantive NPDES standards include technology-based pollutant controls, or effluent standards, governing surface water discharges. A NPDES effluent control technology, could, for example, be applicable to the discharge of a treated CERCLA wastewater to any surface water.

Chloride was detected at a level above the toxic criterion continuous concentration for aquatic life at a distance of 1.6 miles from the Site in a heavily used fishery and recreation area. Dissolved residue was detected here at a level that could impair the waterbody's use classification for drinking water, and above the threshold for consumption of water and organism. Other indicator parameters indicating release may include sodium, calcium, and potassium. Remedial Action is warranted.

6.0 SOIL EXPOSURE AND AIR PATHWAYS

6.1 Physical Conditions

The Smokey Mountain Smelters Site lies in a medium commercial and dense residential area adjacent to the Knoxville City Limit. The Site is accessible because the Site property boundaries are not completely fenced to prevent access to the facility. There are many entrances to the main building. It is believed that unauthorized entries into the building and onto the disposal area have occurred.

An estimated 100,000 cubic yards of uncontained wastes are on-site. Particulate migration could occur. A large portion of the wastes is baghouse dust. Historical emissions could have caused migration of particulates to off-site locations, mostly to the northeast and southwest (Ref 38).

Site soil types identified by the Soil Conservation Service on Figure 6 include Armuchee and Litz soil materials (G_E), Leadvale and Whitesburg silt loams undulating phases (L_D), Lindside silt loam (L_G), and Sequoia silty clay loam eroded rolling phase (S_K). A general description of the soil types is provided in the Knox County Soil Survey (Ref 35).

By observation and air monitoring, the waste has been found to be emitting ammonia to the atmosphere. Exposure of aluminum smelting dross to moisture generates ammonia and heat. Passive dosimeter tubes were previously used to detect ammonia at on-site locations. The Direct Observation of 20-ppm ammonia gas release occurred.

The odor of ammonia was detected during Site inspections (Field Notes, Appendix 3). The odor threshold for ammonia in air is 46.8 ppm (Wark Warner 1981).

Particulate and gaseous migration is likely to occur. The wastes include fine-particle baghouse dust. The prevailing winds are to the southwest and northeast (Ref 38), where there are primary targets.

6.2 Soil and Air Targets

Access to the site is unrestricted, thus, soil exposure could occur if unauthorized persons enter the facility. Potential targets along the on-site soil pathway appear to be adults and children from area neighborhoods, and vagrants.

Hazardous substances are migrating from the waste piles to points along the surface water pathway, which passes through residential areas. Potentially contaminated sediments are deposited soil in wet weather conveyances, along the edge of streams, and in the floodplain along the surface water pathway.

An estimated 64,408 people live within four miles of the Site, based on the 1990 census data (Ref 45). An estimated 55,613 people live within four miles of the Site, based on the 2000 census data (Ref 34). There is no resident population. The nearest residence (Figure 4) is less

* Although investigation of attribution from upper Flenniken Branch was omitted in Phase I samples, the investigation of attribution of indicator parameters (chlorides, dissolved solids, conductivity, etc.) from upper Flenniken Branch in Phase II and the investigation of attribution from upper Flenniken Branch during the Site Investigation indicated no significant attribution of chemicals of concern from upper Flenniken Branch.

than 200 feet away from an off-site source of contaminated soil near the Site. The nearest presently operating daycare facility and school (Ref 12, Figure 4) are over 200 feet away from confirmed areas of contamination at or near the Site. 207 persons (primary targets) reside within ¼ mile.

Proportioned by area, by distance category, the following target populations have been estimated:

distance category	area	target populations
0 to ¼ mile	0.196 square miles	217
¼ to ½	0.589	651
½ to 1	2.36	2609
1 to 2	9.42	10,415
2 to 3	15.7	17,358
3 to 4	22.0	24,324
0 to 4	50.3	55,613

The nearest school (Ref 12, Figure 4) and presently operating childcare facility are over 200 feet away from suspected areas of contamination at the Site. The nearest residence (Figure 4) is less than 200 feet from the Site boundary.

6.3 Soil Sample Locations

Sediment soil sample locations are shown in Figure 3A and in Figure 3C. The sediment soil sample descriptions are summarized in Table 1.

Several sediment soil samples were collected from locations where there was no water flow or the water depth was minimal. There is thought to be potential for human exposure via the soil exposure pathway at these locations.

Several waste samples were collected from accessible, exposed waste piles. There is thought to be potential for human exposure via the soil exposure pathway at these locations.

Sixteen sediment soil samples were collected, including three backgrounds or controls and one duplicate. The background sediment soil samples were collected from unnamed tributaries of Flenniken Branch upgradient of the confluences with the surface water pathway from sources at the Site.

SD-15 was a sediment sample collected from a dry, on-site pond. It was evaluated as an investigation of the pond contents and soil characteristics and not as a contributor to the surface water pathway evaluation.

6.4 Soil Analytical Results

The sediment soil sample locations, analytical results, requests, and chain-of-custody information from Phase 1 are presented in Appendix 2 and summarized in Table 5, "Sediment Soil Analytical Results".

Wastes on the surface at the Site were sampled and were found to contain numerous inorganic and extractable organic hazardous substances being released, as shown in Table 2 and in Table 2A. Most of these contaminants are hazardous substances to which exposure may occur.

There were numerous exceedances of criteria of concern due to accessible, exposed waste piles. There is thought to be potential for human exposure via the soil exposure pathway at these locations. Residential and industrial soil preliminary remediation goals, soil-screening levels, and sediment screening levels were exceeded for several inorganic and extractable organic hazardous substances.

The analytical results of the sediment soil samples indicated the presence of several hazardous substances, both on-site and off-site. The observed release criteria for chemical analysis were satisfied for several inorganic contaminants and toluene.

Observed releases in off-site sediment soil samples were indicated for the following:

aluminum	magnesium	toluene
cadmium	nickel	zinc
copper	sodium	

Criteria of concern exceeded included residential and industrial soil preliminary remediation goals, soil screening levels, and sediment screening levels for several inorganic hazardous substances including aluminum, cadmium, copper, nickel, zinc, and toluene.

6.5 Air Monitoring

No air monitoring was conducted. The odor of ammonia at the waste piles is frequently noticeable, as noted during waste sample collection. Such is classified as the direct observation of ammonia emissions from waste pile (ESI Report - Appendix 3, Field Notes, 9 11 02, location 1GW).

Previous air monitoring has detected low levels of ammonia.

The presence of asbestos in the process building was investigated and resulted in the direct observation of uncontained Asbestos Containing Materials (ACM) by Polarized Light Microscopy Dispersion Staining Technique on July 12, 2005. See Appendix 2, Phase 2.

6.6 Conclusions

Access to the site is not controlled. Hazardous substances are present in waste piles, so exposure can occur when unauthorized entry to the site occurs. The presence of hazardous substances contaminating the surface at this Site has been confirmed.

Releases of contaminants to both on-site and off-site sediment soil from on-site wastes are indicated by analytical data. On-site disposal of aluminum smelting wastes in an uncontained manner has occurred and caused migration of contaminants to both on-site and off-site sediment soil. The on-site, subsurface presence of agricultural chemical wastes is suspected, but remains inadequately investigated.

There is no population residing within the three real estate parcels upon which the Site lies. The nearest school and childcare facility are more than 200 feet away from confirmed areas of contamination, however, not all areas have been investigated. The nearest residences are in Montgomery Village, a group of multiple housing units, slightly less than 200 feet to the east.

The nearest residences to the northeast are more than 200 feet away from areas of confirmed contamination; however, one residence appears to be on or very near to Parcel #6, which may have been previously owned by the Site owner.

Hazardous substances were found in the main building and scattered throughout the southern half of the property. Particulate migration via the air pathway could occur, especially from previously operating facilities, which could increase the possibility of exposure via the soil pathway. The air migration pathway is primarily to the northeast and southwest, the directions of the prevailing winds.

Air monitoring was previously performed at the site and ammonia was detected. The large quantity of wastes, uncontrolled access to the Site, the possibility of particulate emissions, and the presence of primary targets make further inspection of exposure via the air pathway of importance. The Smokey Mountain Smelters Site could pose a threat to human health and or the environment via the air pathway, particularly if the waste piles are disturbed or if water is added to wastes that are presently buried.

7. SUMMARY AND CONCLUSIONS

The large quantity of uncontained hazardous substances known to be present at Smokey Mountain Smelters, and indicated to be migrating to soil, surface water, groundwater, and air, necessitates further investigation, and, possibly, interim remedial action.

Water and sediment quality in the surface water pathway leading to a fishery downstream of the Site is a concern. The wastes at Smokey Mountain Smelters have been found to contain several bioaccumulative, toxic, and persistent hazardous substances that are also in the sediments and water. Surface water quality is impaired due to contaminant contributions from wastes on this Site.

Potential for human exposure may exist through the groundwater pathway. A total of 2524 persons within the four miles radius of karst terrain are estimated to use groundwater that could contain bioaccumulative, toxic, and persistent hazardous substances.

A high potential for human exposure may exist through the soil exposure and air pathways, due to a lack of containment at the Site, which is near a heavily populated area. The site is probably entered by unauthorized persons; and is located within $\frac{1}{4}$ mile of approximately 217 people and several residences, and approximately one mile from an elementary school.

The Smokey Mountain Smelters Site appears to have the potential to be placed on the National Priorities List. The property is recommended for immediate remedial action.

✠✠✠

LIST OF REFERENCES

SMOKEY MOUNTAIN SMELTERS
1508 MARYVILLE PIKE
KNOXVILLE, TENNESSEE 37920
U.S. EPA # TN0002318277 TSDF #47-559

#	REFERENCE	PAGE
1	Burress, J. 1994. (Plant Manager, Smokey Mountain Smelters). Letter to D. Henshaw (Knox County Air Pollution Control), RE: operations, May 3.	6 14 18
2	Duncan, J. 1983. (Congress of the United States). Letter to J. Lovett (Director of Knox County Department of Air Pollution Control), RE: Complaint, July 27.	6
3	European Fertilizer Manufacturers Association (EFMA). 1997. "Production Processes". http://www.efma.org/manufacturing/section01.asp	5
4	FEMA. 1983. Flood Insurance Rate Map. Knox County, Tennessee (Unincorporated Areas), Federal Emergency Management Agency. Community-Panel Number 475433 0190 B, Panel 190 of 235. May 16.	18
5	Hawley, G. 1981. The Condensed Chemical Dictionary, Tenth Edition. New York:Van Nostrand Reinhold Company, Inc. pgs. 41,288, 394, 622-3, and 927.	8
6	KCDAPC. 1980. Permit Application, Form APC-1. Received by the Knox County Department of Air Pollution Control, filed by Dan E. Johnson, President, Smokey Mountain Smelters, Inc. November 7.	3 5
7	KCDAPC. 1983. Facility Inspection Report, David Witherspoon, Inc. - Witherspoon and Johnson Dump. Inspected by the Knox County Department of Air Pollution Control, December 5.	6
8	KCDAPC. 1985a. "David Witherspoon - Historical Record", Knox County Department of Air Pollution Control.	6
9	KCDAPC. 1985b. "Permit To Operate A Potential Air Contaminant Source" issued by Knox County Department of Air Pollution Control. September 11.	9
10	KCDAPC. 1989. "List of complaints, inspections, and Departmental action", Knox County Department of Air Pollution Control, August 10.	6 7 8
11	Maupin, B.H. (TDEC/DSF). 1997a. Estimation of the groundwater pathway secondary target population. December 1997.	16

(continued)

LIST OF REFERENCES (continued)
SMOKEY MOUNTAIN SMELTERS
1508 MARYVILLE PIKE
KNOXVILLE, TENNESSEE 37920
U.S. EPA # TN0002318277 TSDF #47-559

#	REFERENCE	PAGE
12	Maupin, B.H. (TDEC DSF). 1997b. "Features within a four miles radius of Smokey Mountain Smelters". December.	29
13	Maupin, B.H. (TDEC DSF). 1997c. "Home and unspecified-use wells within a four miles radius of Smokey Mountain Smelters". December.	5
14	Maupin, B.H. (TDEC DSF). 1997d. Potential Hazardous Waste Site - Site Identification ("Discovery") August 6.	6
15	Maupin, B.H. (TDEC DSF). 2004. Hazardous waste quantity calculation. February.	27
16	Maupin, B.H. (TDEC DSF). 2005a. Regulated Inactive Secondary Aluminum Smelting Waste Disposal Areas. March.	9
16 A	Maupin, B.H. (TDEC Division of Remediation (DOR)). 2005b. Liability at Smokey Mountain Smelters, memo to R. Powell, DOR Enforcement and Cost Recovery Manager. April 29.	7 8 9
17	Maupin, B.H. (TDEC DSF). 2005c. Wetlands Inventory. August.	20
18	NARI. 1973. Standard Classification for Nonferrous Scrap Metals. National Association of Recycling Industries, Inc., Circular NF-73, April 1. pgs 1-8.	7
19	OMB. 1987. Standard Industrial Classification Manual. Executive Office of the President, Office of Management and Budget, pgs 146-8, 176-8.	5 9
20	Sanborn. 1924, 1948. "Insurance Maps of Knoxville, Tennessee". The Sanborn Map Company, New York. Volume Two.	3 4 5
21	TDC Division of Geology (DG). 1956. "Ground-Water Resources of East Tennessee". State of Tennessee, Department of Conservation, Division of Geology, Bulletin 58, Part 1, pp. 6-9, 12, 43-4, 245-68, Plate 9 (See Figure 5, "GEOLOGIC MAP").	3 5 15

(continued)

LIST OF REFERENCES (continued)
SMOKEY MOUNTAIN SMELTERS
1508 MARYVILLE PIKE
KNOXVILLE, TENNESSEE 37920
U.S. EPA # TN0002318277 TSDF #47-559

#	REFERENCE	PAGE
22	TDEC Division of Natural Heritage (DNH). 1996. "Project review information for endangered species and critical or sensitive habitat," memorandum to F. Grubbs (TDEC DSF NCO) from A. Barass (TDEC DNH), dated August 13. Smokey Mountain Smelters Knoxville, Tennessee 37920 U.S. EPA # TND098071061 TSDF #47-559.	19 20
23	TDEC Division of Remediation - Knoxville (DORK). 2004. "Additional Study Plan - Extended Site Screening Investigation", Tennessee Department of Environment and Conservation, Division of Remediation. February 24.	18 21
24	TDPH Division of Solid Waste Management (DSWM). 1983. Tennessee Department of Public Health. "Field Activity Report", by J. Crabtree (DSWM), dated March 23.	6
25	TDHE DSWM. 1983a. Letter to D. Johnson (Smokey Mountain Smelters), RE: Geologic Evaluation of Proposed Industrial Storage Yard and Landfill, November 18.	6
26	TDHE DSWM. 1983b. "Report of Geologic Investigation", by G. Pruitt (DSWM), dated November 4.	5 6 9 17
27	TDHE DSWM. 1990. Tennessee Department of Health and Environment, Special Solid Waste Notice of Approval (Letter #2468 2640), issued to Smokey Mountain Smelters, Inc. October 12.	6
28	TDEC Division of Water Pollution Control (DWPC). 2004. State of Tennessee Water Quality Standards, Chapter 1200-4-4, Use Classifications for Surface Waters. pp: 15-16. Chapter 1200-4-3-.08, Ground Water Criteria. pp:26-27. January.	18 19
29	TDEC Division of Water Supply (DWS). 1997a. Records of Water Wells on the Knoxville Quadrangle (0147NW) TN. November 12. Pp.:13-23.	15
30	TDEC DWS. 1997b. Records of Water Wells on the Maryville Quadrangle (0147SW) TN. November 12. Pp.:35-43.	15
31	TDEC DWS. 1997c. Records of Water Wells on the Shooks Gap Quadrangle (0147NE) TN. November 12. Pp.:1-12.	15

(continued)

LIST OF REFERENCES (continued)
SMOKEY MOUNTAIN SMELTERS
1508 MARYVILLE PIKE
KNOXVILLE, TENNESSEE 37920
U.S. EPA # TN0002318277 TSDF #47-559

#	REFERENCE	PAGE
31A	TDEC DWS. 2002. Tennessee Ground Water 305b Water Quality Report. November. Pp. 6-9	15
32	TN Department of State Division of Business Services. 2005. Business Information and Business Filing History, searchable database. Rotary Furnace, Inc. Smokey Mountain Smelters, Inc.	5
33	TWRA. 1993. "Fort Loudoun Reservoir Annual Report". Tennessee Wildlife Resources Agency, Region IV. Prepared by D. Peterson and J. Negus.	18 19
34	USBC. 2000. United States Bureau of the Census: State and County QuickFacts. Dara derived from Population Estimates, 2000 Census of Population and Housing.	15 29
35	USDA SCS. 1955. Soil Survey Knox County Tennessee, (with map). U.S. Department of Agriculture Soil Conservation Service. August. pages: 4-9, 12-27, 102-5, 116-19, 136-7, 198-203, 220-23, 226-7, 230-1, 234-5, 238-9, and Soil Map - Knoxville Quadrangle (Figure 6 - Soil Map).	5 17 18 28
36	USDC. 1993. Rainfall Frequency Atlas of the United States. U.S. Department of Commerce, Hydrologic Services Division. July. Chart 44, page: 95.	3 18
37	USDC NOAA. 2004 2002. National Weather Service Forecast Office, Knoxville Monthly Climate Data. U. S. Department of Commerce, National Oceanic and Atmospheric Administration.	21
38	USDC NOAA. 1968. Climatic Atlas of the United States. U. S. Department of Commerce, National Oceanic and Atmospheric Administration. June. page: 78.	3 28
39	USDHHS. 1994. Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. June. pgs 14-15.	9
40	USDHHS. 1998. Health Consultation. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Division of Health Assessment and Consultation, August 27. pgs 1-4	6

LIST OF REFERENCES (continued)
SMOKEY MOUNTAIN SMELTERS
1508 MARYVILLE PIKE
KNOXVILLE, TENNESSEE 37920
U.S. EPA # TN0002318277 TSDF #47-559

#	REFERENCE	PAGE
41	U.S. Environmental Protection Agency (EPA). 2001. Potential Recycling of Scrap Metal From Nuclear Facilities. Office of Radiation and Indoor Air. Technical Support Document. Volume I. Appendix B.	8
42	USEPA. 2000. National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production. Final Rule. Federal Register Vol. 65. No. 57 March 23.	9
43	USEPA. 1999. The Class V Underground Injection Control Study. Office of Ground Water and Drinking Water. EPA 816-R-99-014x. Appendix D. Maximum Contaminant Levels and Health Advisory Levels. http: www.epa.gov safewater uic classv pdfs appd.pdf. September. p. D-10.	16
44	USEPA. 1998. Envirofacts Query Results. Zip Code 37920. U.S. Environmental Protection Agency. July 9.	1 6
45	USEPA. 1990. Graphical Exposure Modeling System (GEMS) Database. U.S. Environmental Protection Agency. Compiled from U.S. Bureau of the Census Data (1990).	29
46	USGS. 1942. U.S. Geological Survey. 7.5 minute series Topographic Quadrangle Maps of Tennessee: Knoxville (147-NW) 1942. scale 1:24.000.	4
47	USGS. 1966. U.S. Geological Survey. 7.5 minute series Topographic Quadrangle Maps of Tennessee: Knoxville (147-NW) 1966. scale 1:24.000.	5 17 18
48	USGS. 1978. U.S. Geological Survey. 7.5 minute series Topographic Quadrangle Maps of Tennessee: Knoxville (147-NW) 1978. scale 1:24.000 (see Figure 4. SITE PLAN).	5 18
48	USGS. 1995. U.S. Geolgical Survey. National Water-Use data files. http: water.usgs.gov watuse spread95 tnh895.txt	16
48	USGS. 2005a. U.S. Geolgical Survey. Water Resources of the United States. http: water.usgs.gov GIS huc_name.txt Last updated June 16.	16
48	USGS. 2005b. U.S. Geolgical Survey. Water Resources of Tennessee. http: nwis.waterdata.usgs.gov tn nwis annual calendar_year ?site_no=03497000	18

(continued)

LIST OF REFERENCES (continued)
SMOKEY MOUNTAIN SMELTERS
1508 MARYVILLE PIKE
KNOXVILLE, TENNESSEE 37920
U.S. EPA # TN0002318277 TSDF #47-559

49	Wark K. And Warner C. 1981. Air Pollution - Its Origin and Control. Second Edition. New York: Harper & Row. Pp: 97 and 477.	8
50	White, J. 1995. Directory of Tennessee Manufacturers. M. Lee Smith Publishers and Printers LLC.	3 5 7
51	White, J. 1997. Directory of Tennessee Manufacturers. M. Lee Smith Publishers and Printers LLC.	3

Parcel 122LE001 - Property Map and Details Report

Parcel Information (last updated: 8/30/2005)

Location Address:	1508 MARYVILLE PIKE
CLT Map:	122
Insert:	L
Group:	E
Condo Letter:	
Parcel:	001
Parcel ID:	122LE001
Parcel Type:	NORMAL
District:	D9
Ward:	
Subdivision:	
Recorded Acreage:	0.00
Calculated Acreage:	7.75
Recorded Plat:	
Recorded Deed:	1691 - 646
Deed Type:	DEED
Deed Date:	

Address Information(last updated: 8/30/2005)

Site Address:	1508 MARYVILLE PIKE KNOXVILLE - 37920
Address Type:	BUSINESS
Site Name:	

Owner Information (last updated: 8/30/2005)

JOHNSON DANIEL E
0 P O BOX 2704
KNOXVILLE, TN 37901

The owner information shown in this section does **not** necessarily reflect the person(s) responsible for Last Year's property taxes. Report any errors to the Knox County Property Assessor's office at (865) 215-2365.

Jurisdiction (last updated: 6/27/2005)

County:	KNOX COUNTY
City / Township:	

MPC Info (last updated: 6/30/2005)

Census Tract:	35
Planning Sector:	South County
1990 Traffic Zone:	63
2000 Traffic Zone:	63

Please contact Knox County Metropolitan Planning Commission (MPC) at (865) 215-2500 if you have questions.

Parcel 122LE00101 - Property Map and Details Report

Parcel Information (last updated: 8/30/2005)

Location Address:	0 MARYVILLE PIKE
CLT Map:	122
Insert:	L
Group:	E
Condo Letter:	
Parcel:	00101
Parcel ID:	122LE00101
Parcel Type:	NORMAL
District:	D9
Ward:	
Subdivision:	
Recorded Acreage:	0.00
Calculated Acreage:	3.70
Recorded Plat:	
Recorded Deed:	1856 - 26
Deed Type:	DEED
Deed Date:	

Address Information(last updated: 8/30/2005)

Site Address:	0 MARYVILLE PIKE KNOXVILLE - 37920
Address Type:	UNUSED LAND
Site Name:	

Owner Information (last updated: 8/30/2005)

JOHNSON DANIEL E
0 P O BOX 2704
KNOXVILLE, TN 37901

The owner information shown in this section does **not** necessarily reflect the person(s) responsible for Last Year's property taxes. Report any errors to the Knox County Property Assessor's office at (865) 215-2365.

Jurisdiction (last updated: 6/27/2005)

County:	KNOX COUNTY
City / Township:	

MPC Info (last updated: 6/30/2005)

Census Tract:	35
Planning Sector:	South County
1990 Traffic Zone:	63
2000 Traffic Zone:	63

Please contact Knox County Metropolitan Planning Commission (MPC) at (865) 215-2500 if you have questions.

Political Districts (last updated: 6/27/2005)

Voting Precinct:	89	Mount Olive
Voting Location:		Mt. Olive School 2507 MARYVILLE
PIKE		
TN State House:	17	Frank Nicely
TN State Senate:	6	Jamie Hagood
County Commission:	9	Larry Clark Paul Pinkston
City Council:		
School Board:	9	Robert Bratton

School Zones (last updated: 8/16/2005)

Elementary:	MOUNT OLIVE ELEMENTARY
Middle:	SOUTH-DOYLE MIDDLE
High:	SOUTH-DOYLE HIGH

Please contact Knox County Schools Transportation and Zoning Department at (865) 594-1550 if you have questions.

Parcel 135CD010 - Property Map and Details Report

Parcel Information (last updated: 8/30/2005)

Location Address:	0 MARYVILLE PIKE
CLT Map:	135
Insert:	C
Group:	D
Condo Letter:	
Parcel:	010
Parcel ID:	135CD010
Parcel Type:	NORMAL
District:	D9
Ward:	
Subdivision:	JOSEPH LEWIS 3RD ADDN
Recorded Acreage:	12.45
Calculated Acreage:	0.00
Recorded Plat:	14 - 214
Recorded Deed:	1962 - 31
Deed Type:	DEED
Deed Date:	

Address Information(last updated: 8/30/2005)

Site Address:	0 MARYVILLE PIKE KNOXVILLE - 37920
Address Type:	UNUSED LAND
Site Name:	

Owner Information (last updated: 8/30/2005)

RIMMER BROTHERS TRUCK PARTS INC
1624 OLD MARYVILLE PK
KNOXVILLE, TN 37920

The owner information shown in this section does **not** necessarily reflect the person(s) responsible for Last Year's property taxes. Report any errors to the Knox County Property Assessor's office at (865) 215-2365.

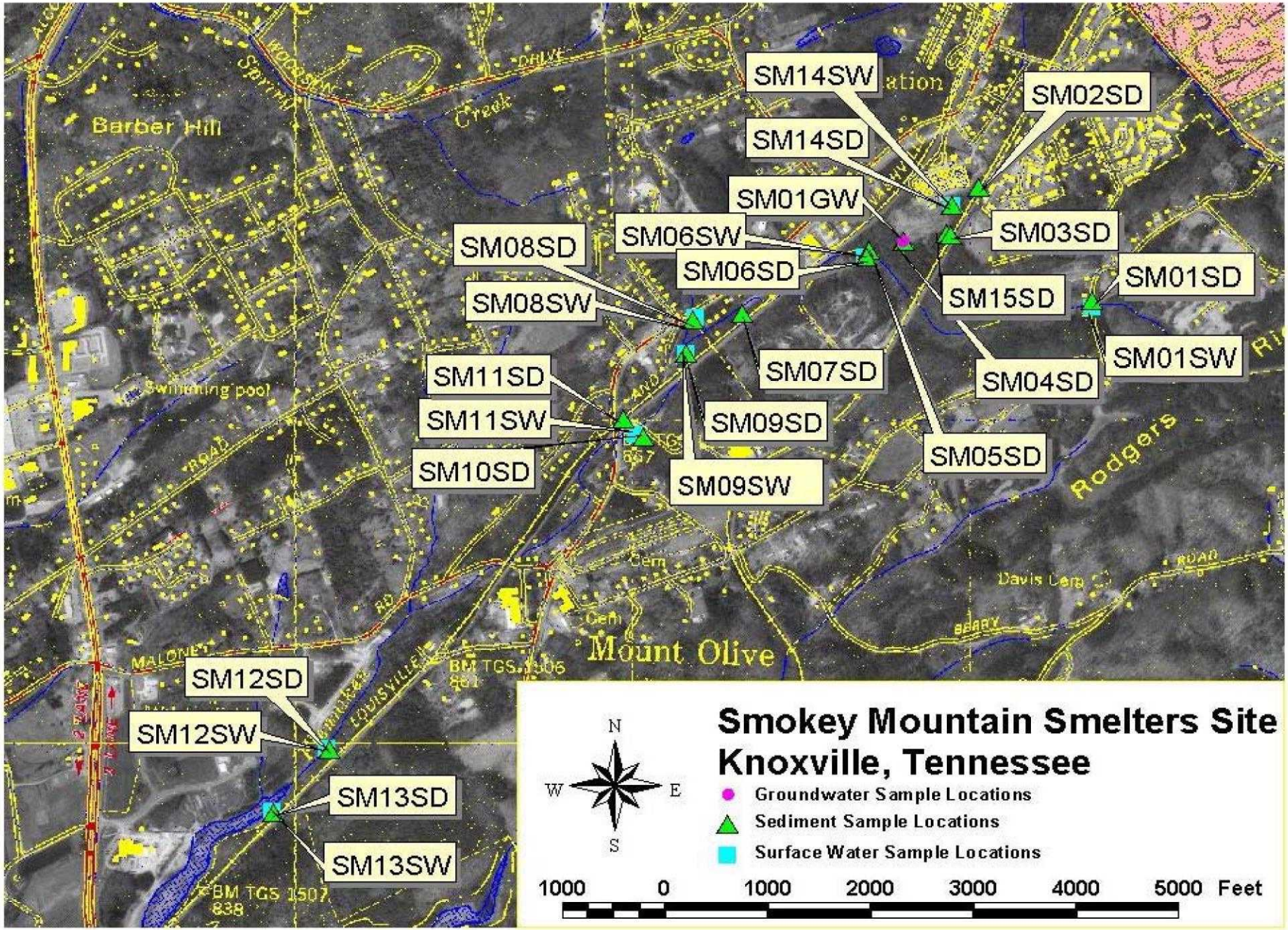
Jurisdiction (last updated: 6/27/2005)

County:	KNOX COUNTY
City / Township:	

MPC Info (last updated: 6/30/2005)

Census Tract:	35
Planning Sector:	South County
1990 Traffic Zone:	63
2000 Traffic Zone:	63

Please contact Knox County Metropolitan Planning Commission (MPC) at (865) 215-2500 if you have questions.


SM14SW
SM02SD
SM14SD
SM01GW
SM03SD
SM06SW
SM08SD
SM06SD
SM01SD
SM15SD
SM08SW
SM01SW
SM07SD
SM04SD
SM11SD
SM11SW
SM09SD
SM05SD
SM10SD
SM09SW
SM12SD
SM12SW
SM13SD
SM13SW
Barber Hill
Swimming pool
Mount Olive
Davis Cem
Rodgers
MALONE
LOUISVILLE
BM TGS 1507
838
N
W
E
S
Smokey Mountain Smelters Site
Knoxville, Tennessee
Groundwater Sample Locations
Sediment Sample Locations
Surface Water Sample Locations
1000 0 1000 2000 3000 4000 5000 Feet

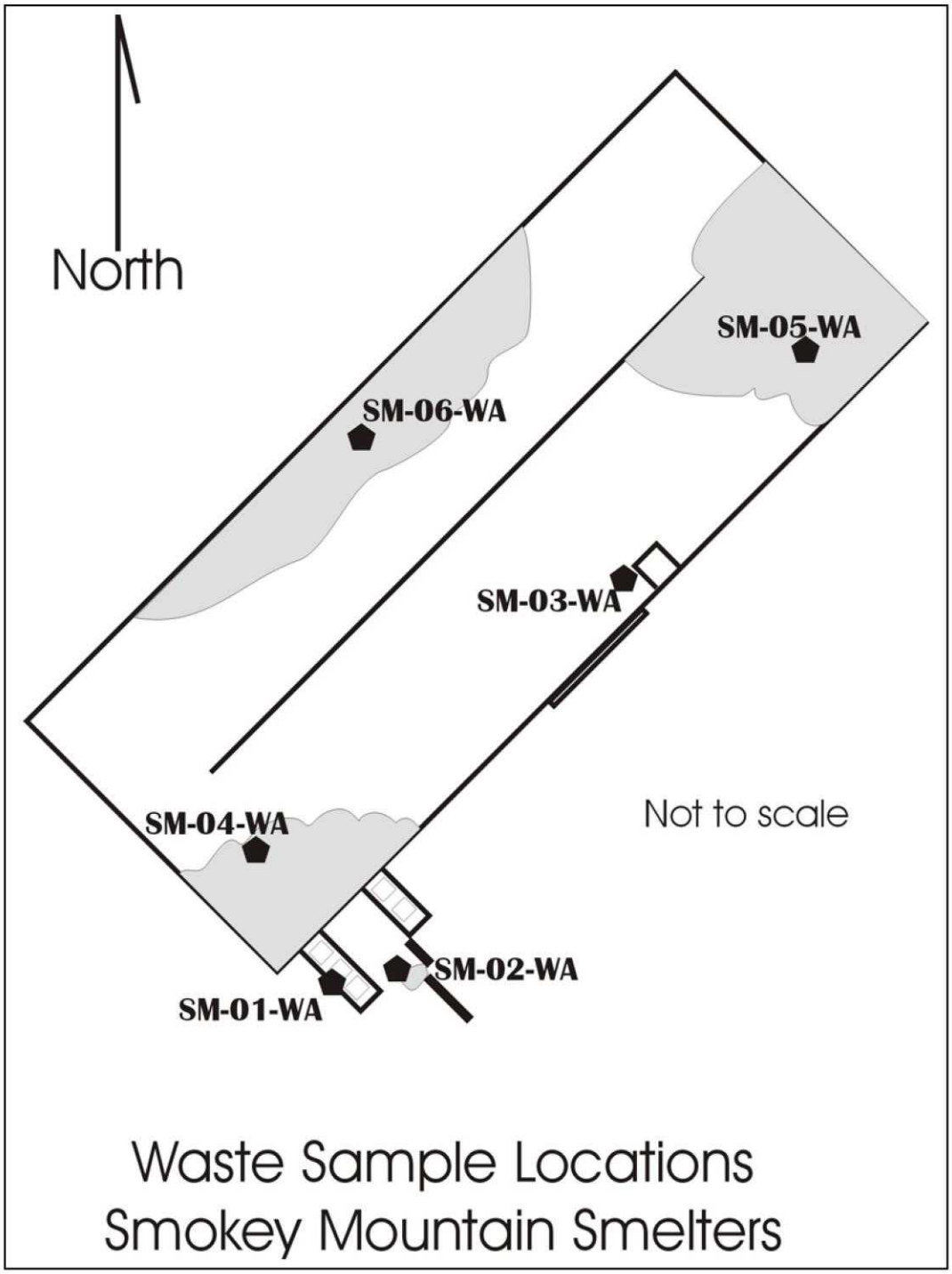
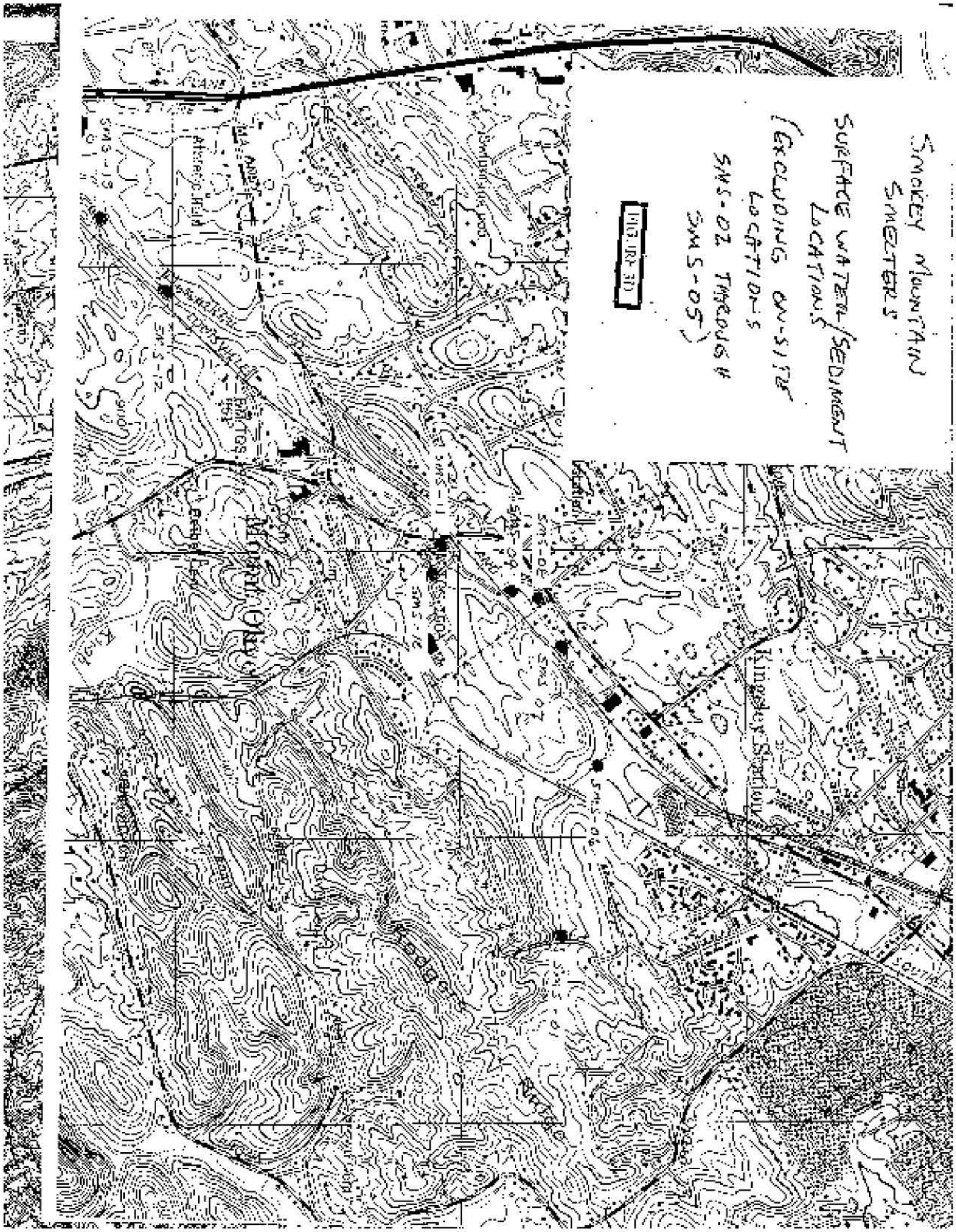

North
SM-05-WA
SM-06-WA
SM-03-WA
Not to scale
SM-04-WA
SM-02-WA
SM-01-WA
Waste Sample Locations
Smokey Mountain Smelters

FIGURE 3B

Smokey Mountain Smelters Site / Knoxville, TN **Photo date: 03/07/97** 0 ---------- 0.05mi

FIGURE 3C selected sample locations / waste pile boundary coordinates / on-site drainage patterns


SMOKEY MOUNTAIN SMELTERS
SURFACE WATER/SEDIMENT LOCATIONS
(EXCLUDING ON-SITE LOCATIONS SMS-02 THROUGH SMS-05)

F 4
site plan

F 5
geologic map

F6
soil map

F7
wetland map

F8
wetland map

F9
wetland map

F10
wetland map